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The Year in Infection Control Act II

Gabriel Birgand
NIHR Health Protection Research Unit in Healthcare Associated Infections and Antimicrobial Resistance

@Gbirgand

Agenda

Prevention of

1. *Clostridium difficile* infections
2. Catheter associated infections
3. Surgical site infections
4. Healthcare-associated pneumonia
5. Emerging issues


INFECTION CONTROL &
HOSPITAL EPIDEMIOLOGY


AJIC
American Journal of Infection Control


THE JOURNAL OF
HOSPITAL
INFECTION
The Official Journal of the Healthcare Infection Society


Eurosurveillance


Clinical
Infectious
Diseases


THE LANCET
Infectious Diseases


EMERGING
INFECTIOUS DISEASES
CDC


The Journal of
Infectious
Diseases


JAMA
The Journal of the American Medical Association


PLOS


NEJM


THE LANCET


BMJ


Journal of
Clinical Microbiology


CMI
CLINICAL
MICROBIOLOGY
AND INFECTION


JAC
Antimicrobial
Chemotherapy


Critical Care
Medicine


ICM

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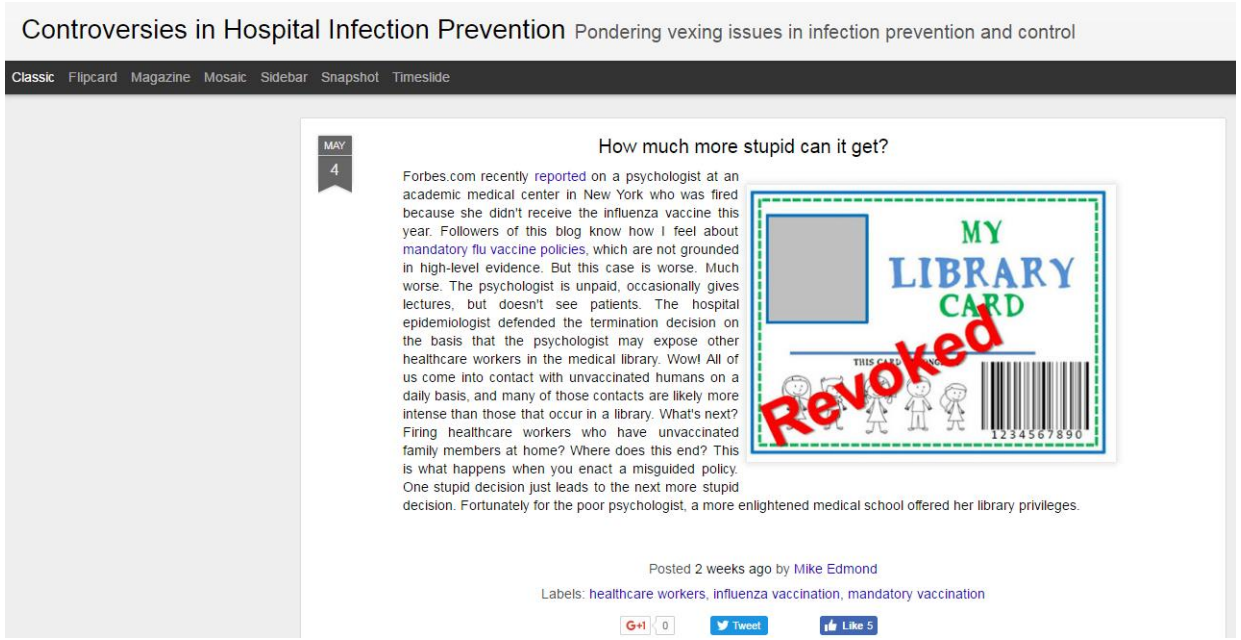
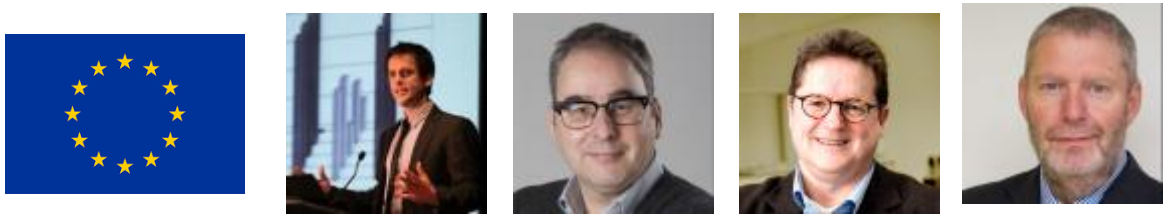
Blogs



http://haicontroversies.blogspot.fr



https://reflectionsipc.com/

Agenda

Prevention of

1. *Clostridium difficile* infections
2. Catheter-line associated infections
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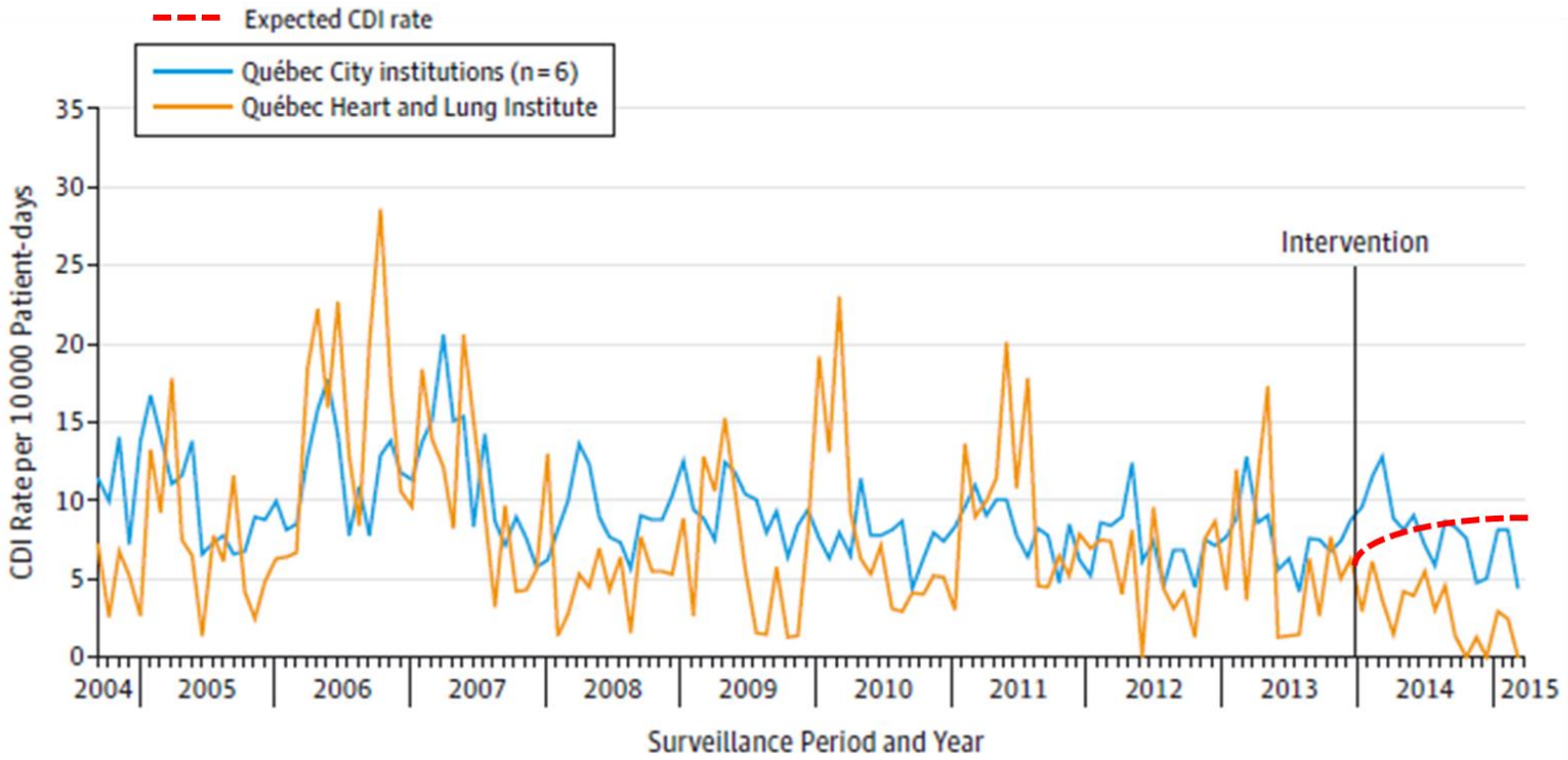
"Search and isolate strategy" for *C. difficile*

•Objective: Effect of detecting and isolating *C difficile* asymptomatic carriers at hospital admission on the incidence of health care–associated CDI.



7599 patients screened

↓

368 (4.8%) asymptomatic carriers

Longtin, JAMA Int Med 2016

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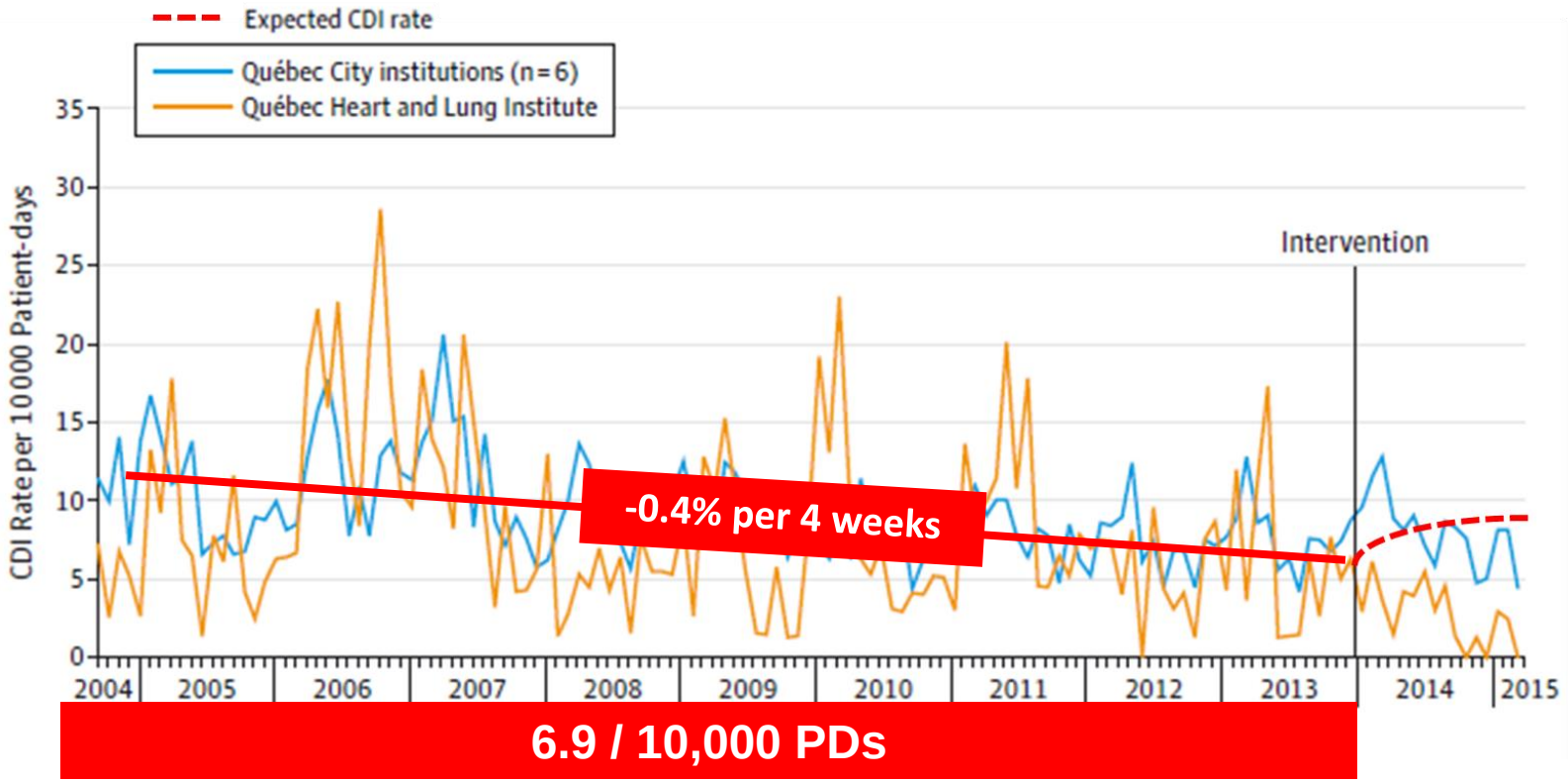

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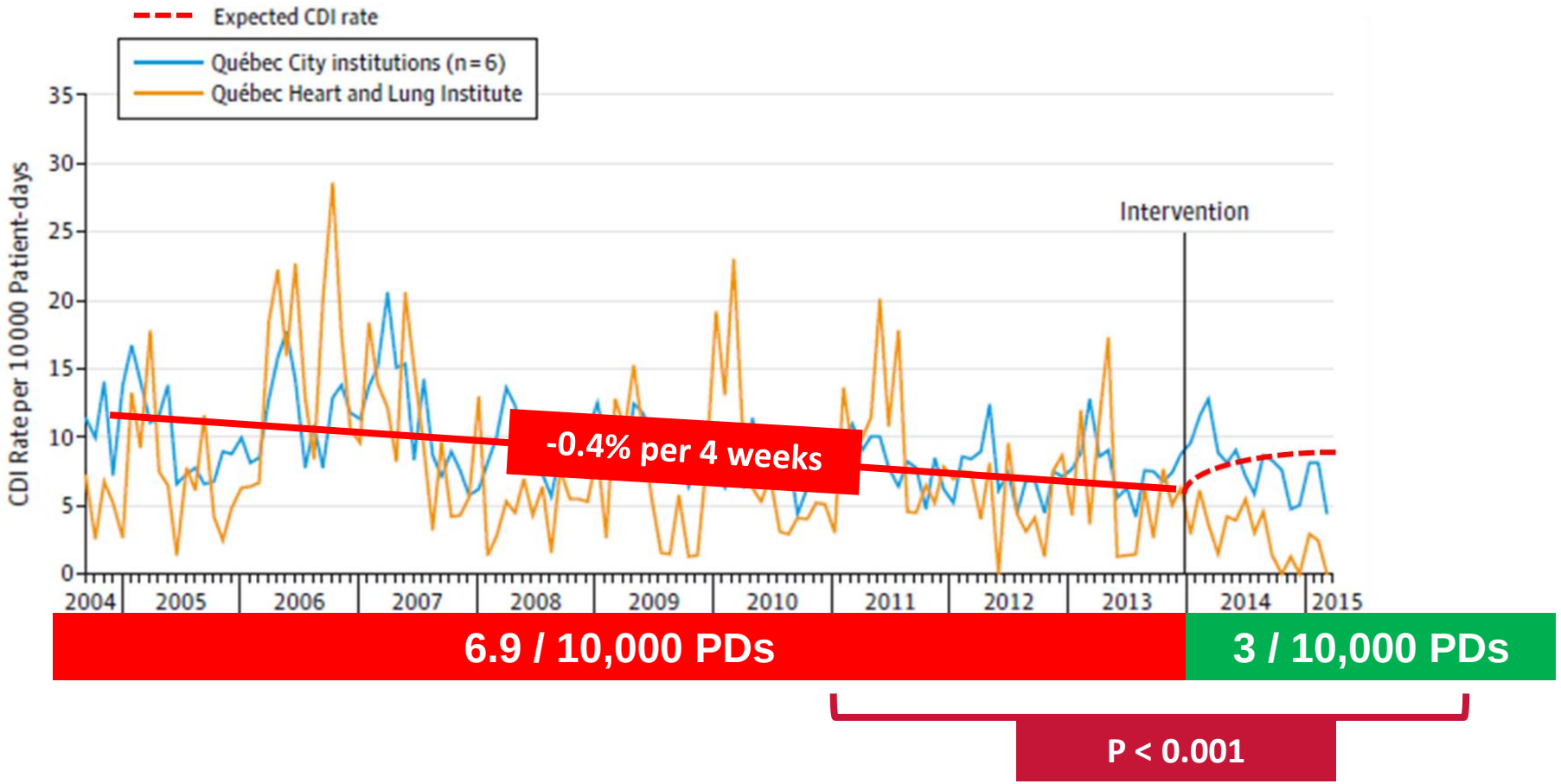

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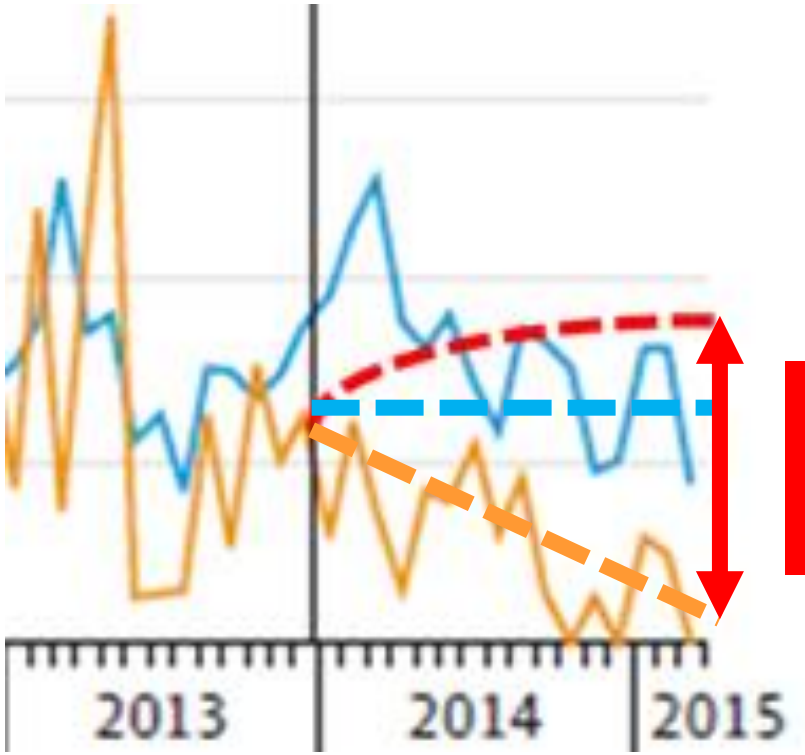

- **- 7.2HA-CDIs per 10000 PDs**
- **62.4% (63/101) HA-CDI prevented**

Longtin, Ann Int Med 2016

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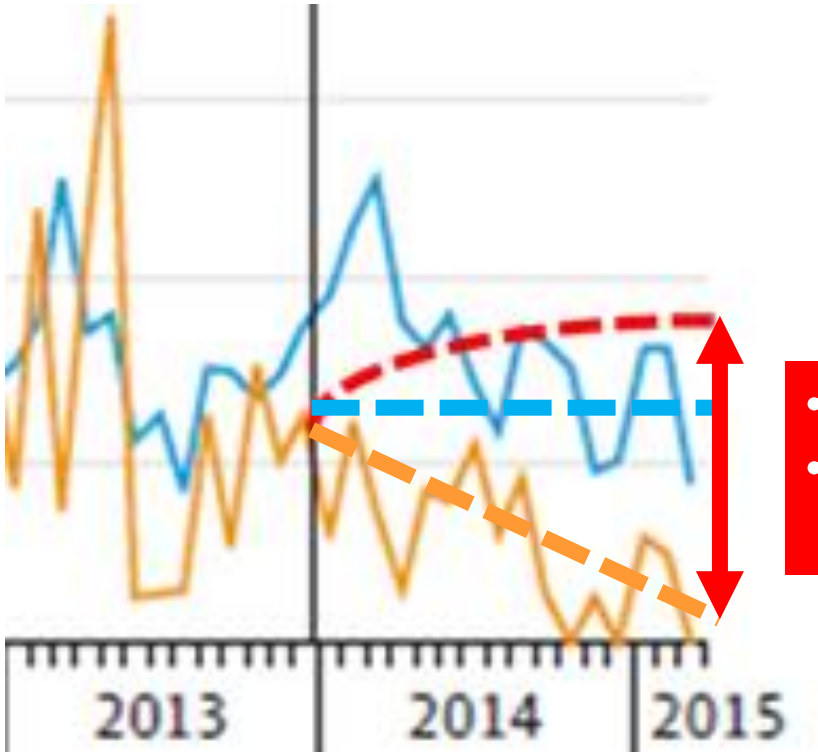
"Search and isolate strategy" for *C. difficile*



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Potential confounders:

- ↗ HH compliance
- ↗ ATB & PPI consumption
- Cost-benefit: $ 86000

Longtin, Ann Int Med 2016

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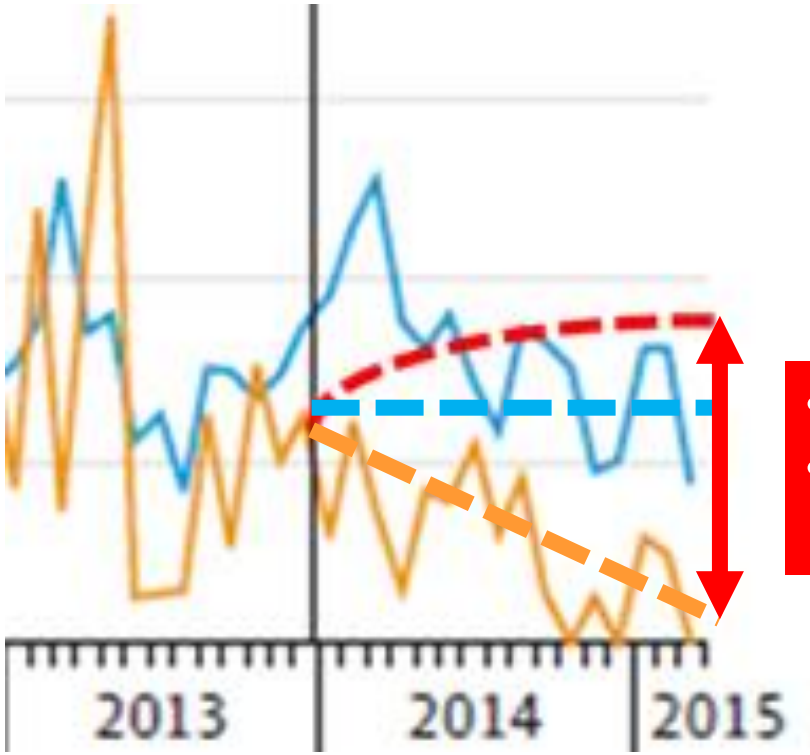
"Search and isolate strategy" for *C. difficile*



Expected CDI rate
Québec City institutions (n = 6)
Québec Heart and Lung Institute

- **- 7.2HA-CDIs per 10000 PDs**
- **62.4% (63/101) HA-CDI prevented**

Potential confounders:

- ↗ HH compliance
- ↗ ATB & PPI consumption
- Cost-benefit: $ 86000

Conclusion: 121 screening → 6 asymptomatic carriers → 1 HA-CDI prevented

Longtin, Ann Int Med 2016

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Refection in IPC debate

Pro arguments

- Minority of *C. difficile* cases detected in hospitals result from transmission in that setting

https://reflectionsipc.com/2016/04/27/should-we-start-admission-screening-for-c-difficile-carriage-a-kiernan-vs-otter-pro-con-debate/

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Refection in IPC debate

Pro arguments

- Minority of *C. difficile* cases detected in hospitals result from transmission in that setting

Con arguments

- Increase in hand hygiene compliance
- Continual progression downwards
- How transferrable is this study?
- Availability of single rooms
- 92.5% of compliance with screening
- Risk of over-diagnosis and over-treatment of *C. difficile*

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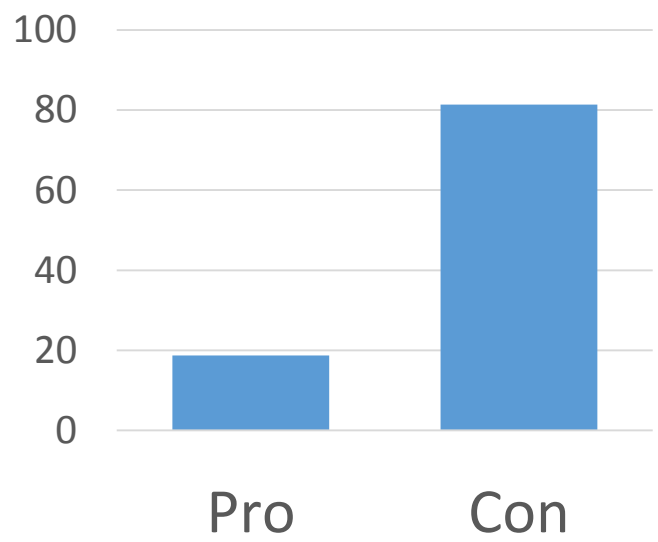
182 Votes



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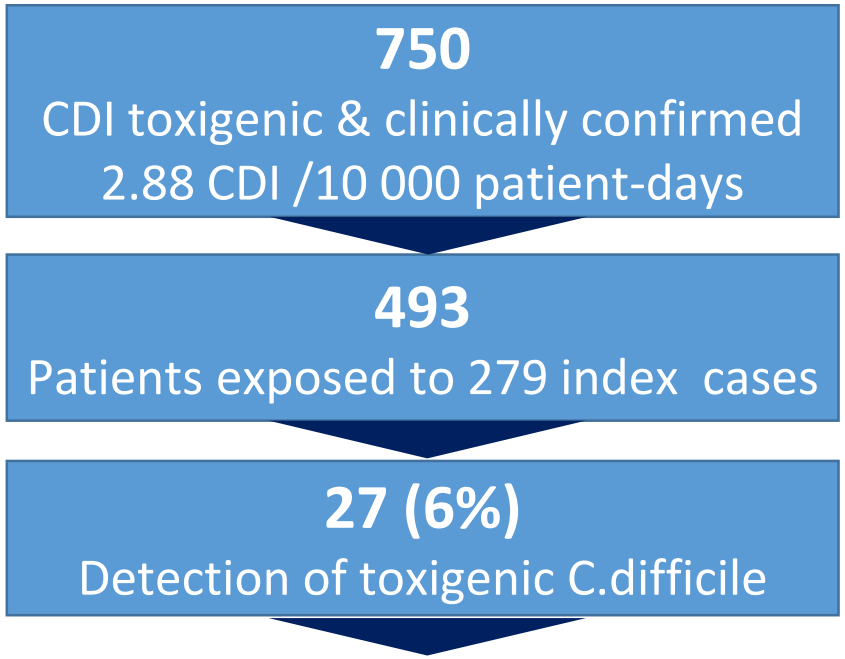
Transmissibility of *C. difficile*



- Objective: Impact of contact precautions for patients with CDI (027, 078 and incontinence)

Widmer CID 2017

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Transmissibility of *C. difficile*

750
CDI toxigenic & clinically confirmed
2.88 CDI /10 000 patient-days

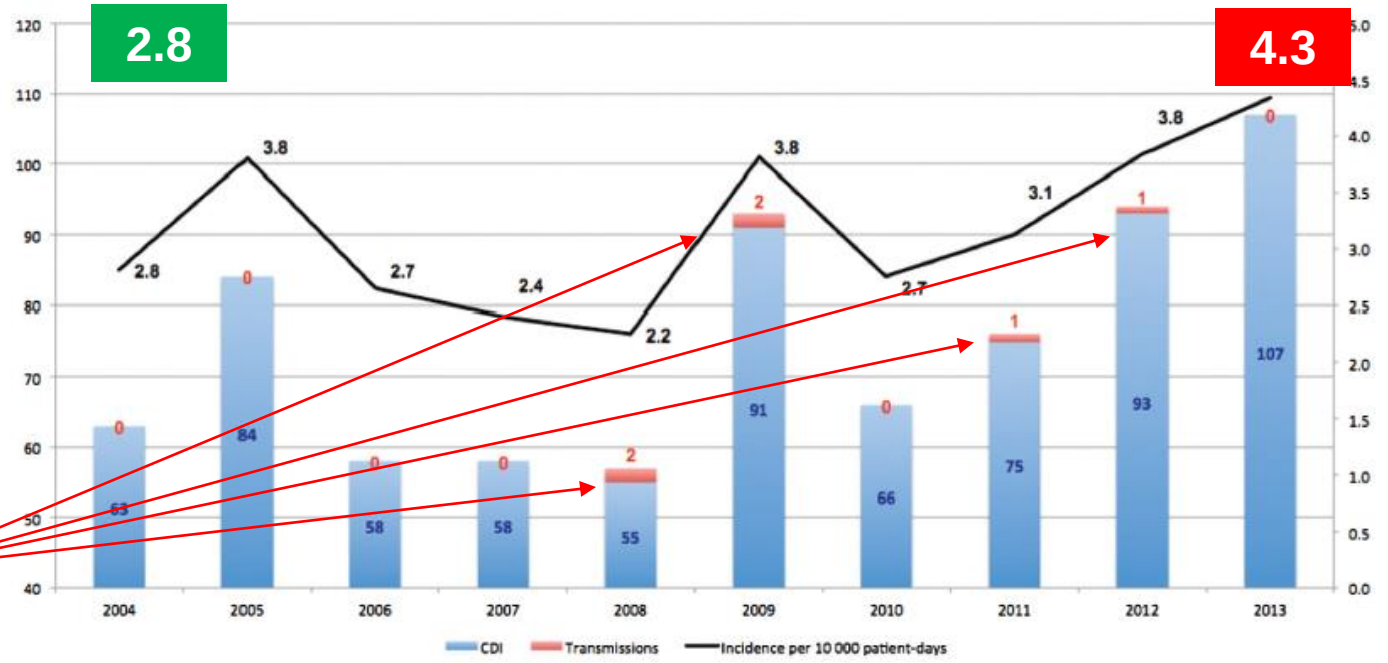
493
Patients exposed to 279 index cases

27 (6%)
Detection of toxigenic C.difficile

6 (1.3%)
Probable transmissions

2
Confirmed transmissions by NGS

- Objective: Impact of contact precautions for patients with CDI (027, 078 and incontinence)



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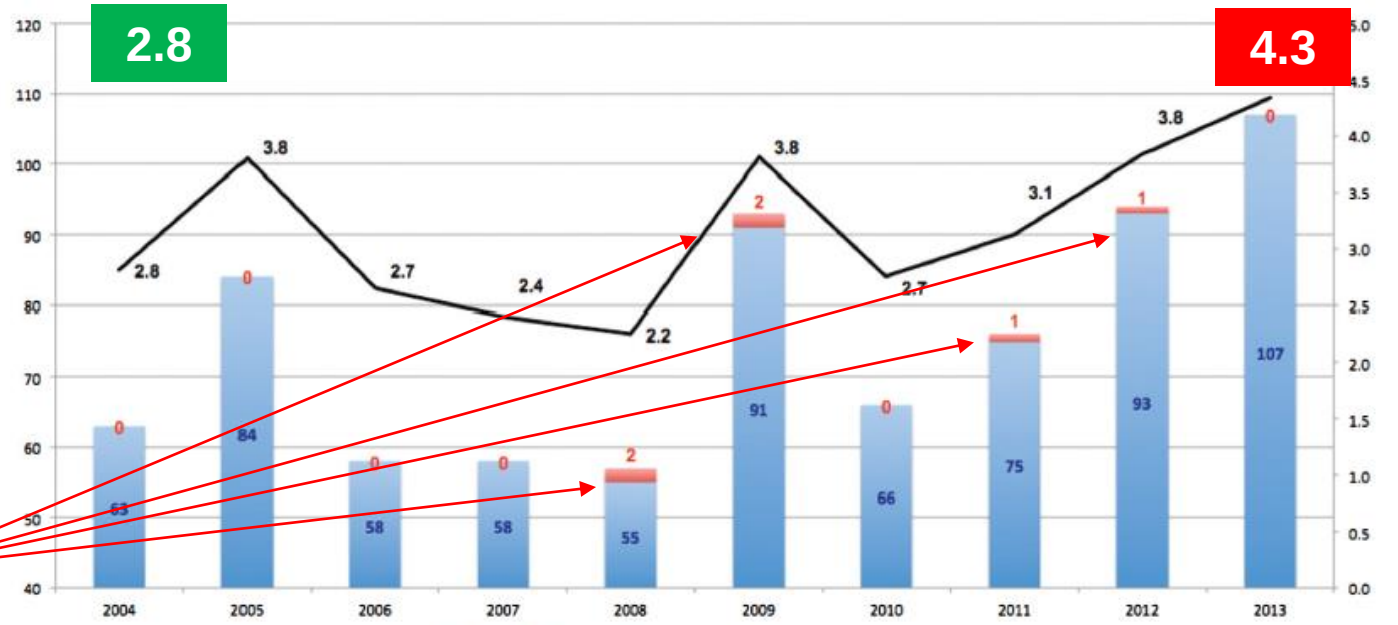

3/128 (2.3%) index patients environment + → toilet seat
Setting: ↗ HH compliance, ↘ ATB & CDI incidence

Widmer CID 2017

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Environmental disinfection & *C. difficile*

- Objective: Impact of an environmental disinfection intervention on CDI incidence
- Intervention: fluorescent marker + high touch surface culture

Ray ICHE 2017

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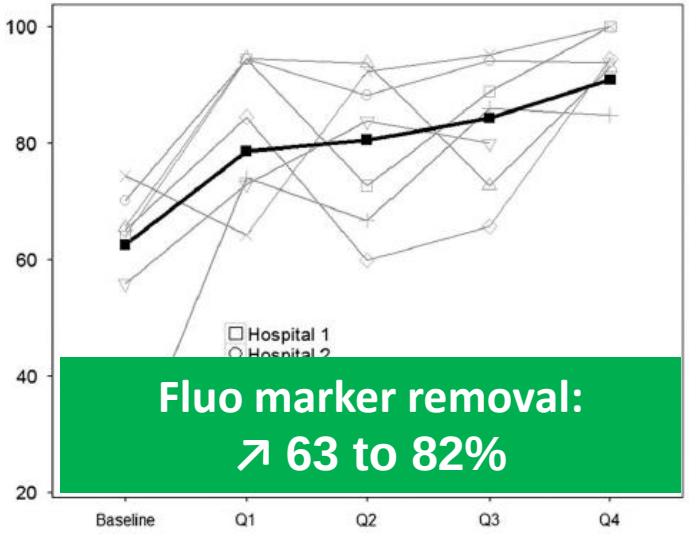

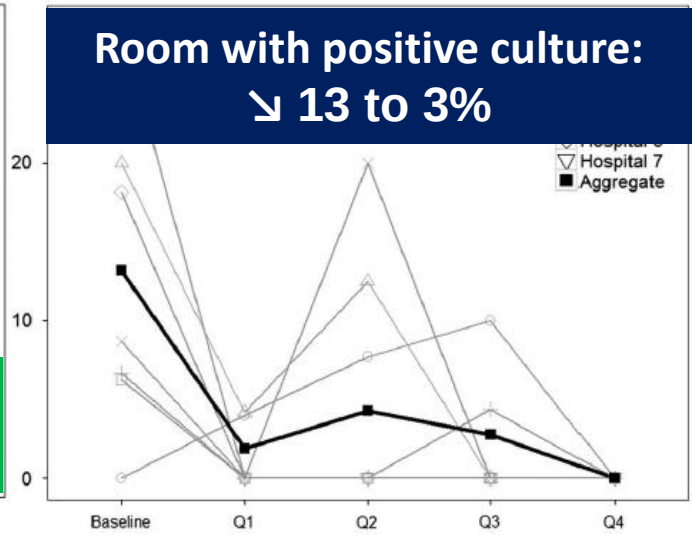

Ray ICHE 2017

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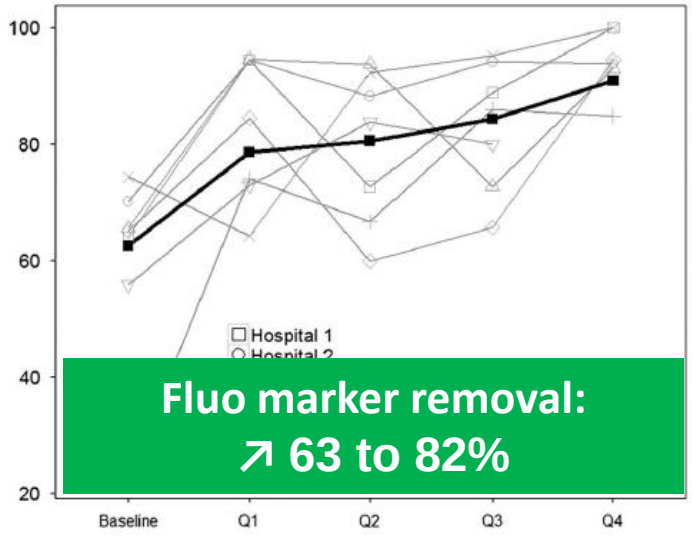
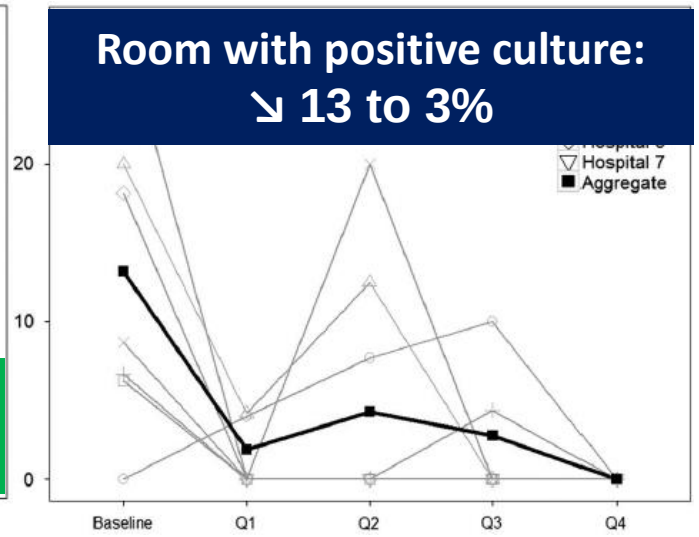
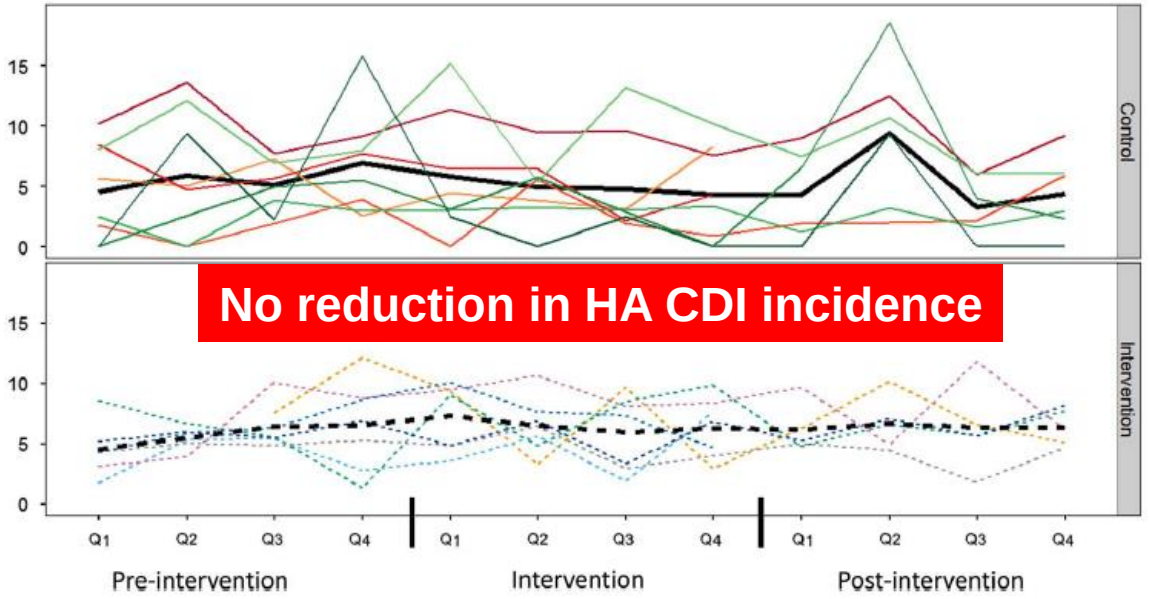


Fluo marker removal:
↗ 63 to 82%

Room with positive culture:
↘ 13 to 3%





No reduction in HA CDI incidence

Ray ICHE 2017

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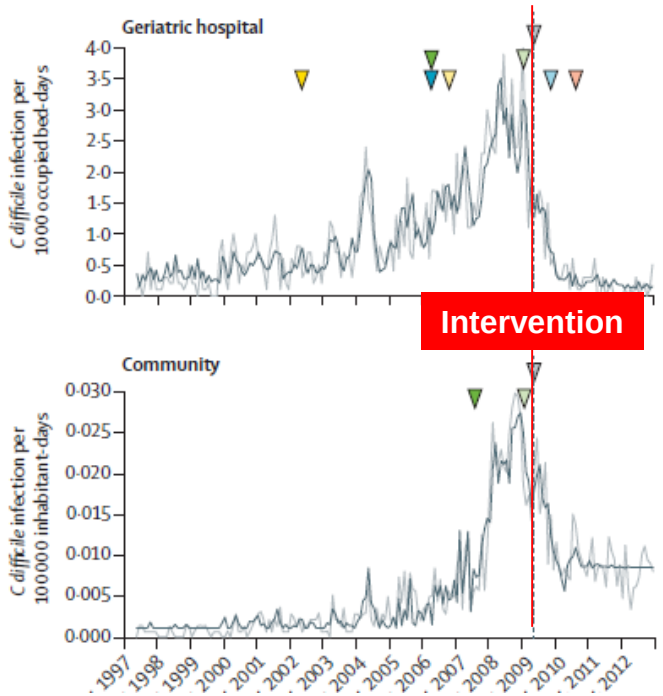
Antimicrobial stewardship & *C. difficile*

- National campaign in Scotland to reduce community and hospital use of antibiotics associated with CDI
  - Guidelines avoiding use of 4Cs: cipro/fluoro, coamoxiclav, clinda, cephalos



Lawes LID 2016

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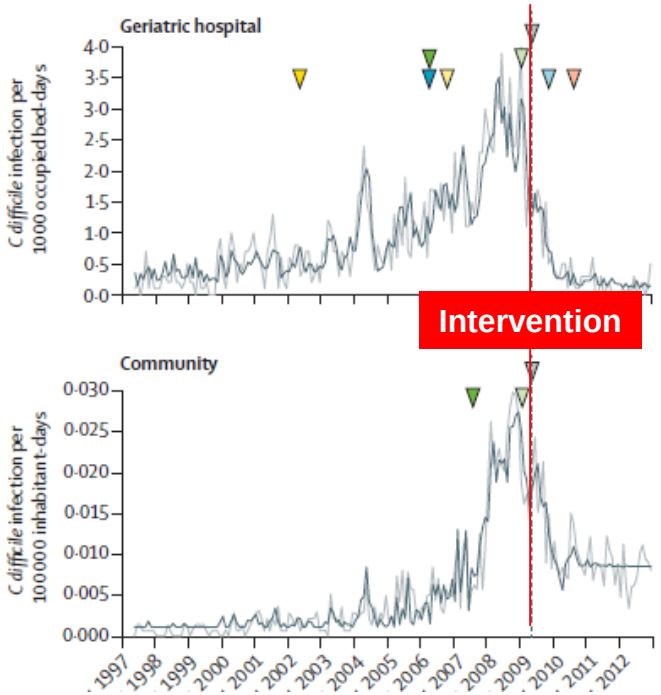

Hospitals

Relative reduction: 68%
→ 374 CDI prevented

Community

Relative reduction: 45%
→ 143 CDI prevented

Lawes LID 2016

Imperial College London

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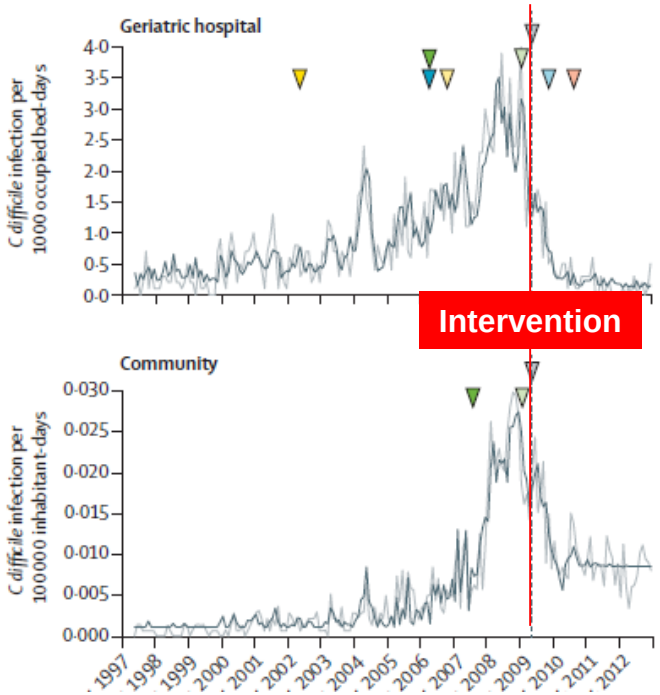


Hospitals

Relative reduction: 68%
→ 374 CDI prevented

Community

Relative reduction: 45%
→ 143 CDI prevented

- No independent effects of IPC
- Carbapenem use associated with CDI
- Total use thresholds → tailored

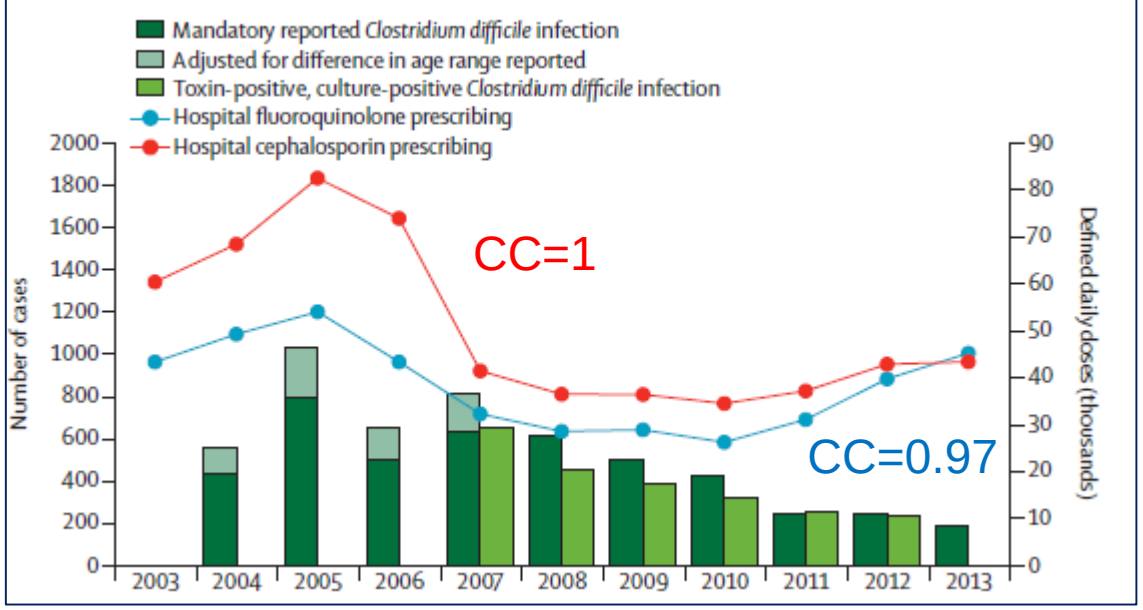
Lawes LID 2016

Imperial College London

Antimicrobial stewardship & *C. difficile*

- What is explaining a decrease in CDI after a national campaign in 2007?

Reductions in use of antibiotics?



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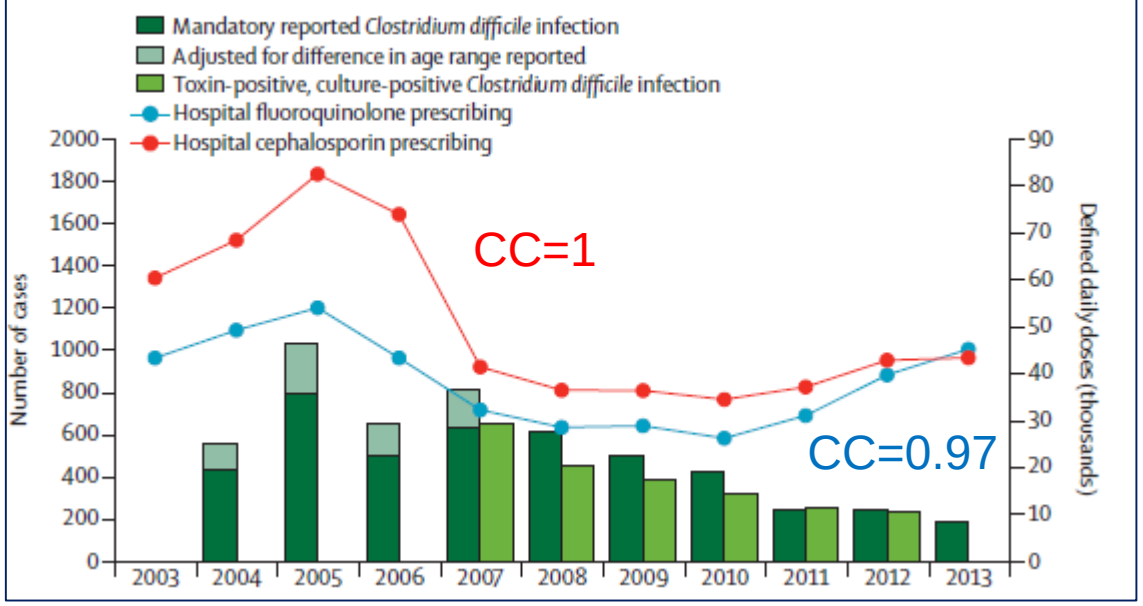
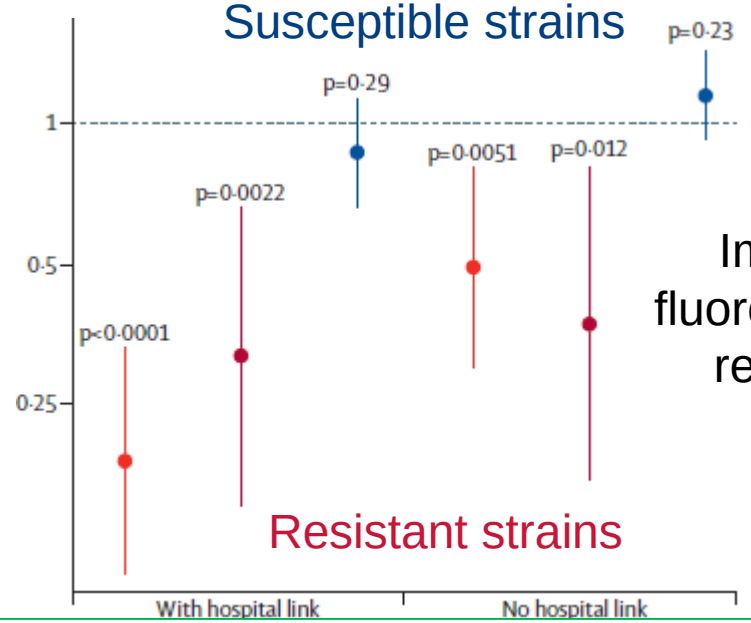


Improvement of IPC activities? inferred secondary CDI



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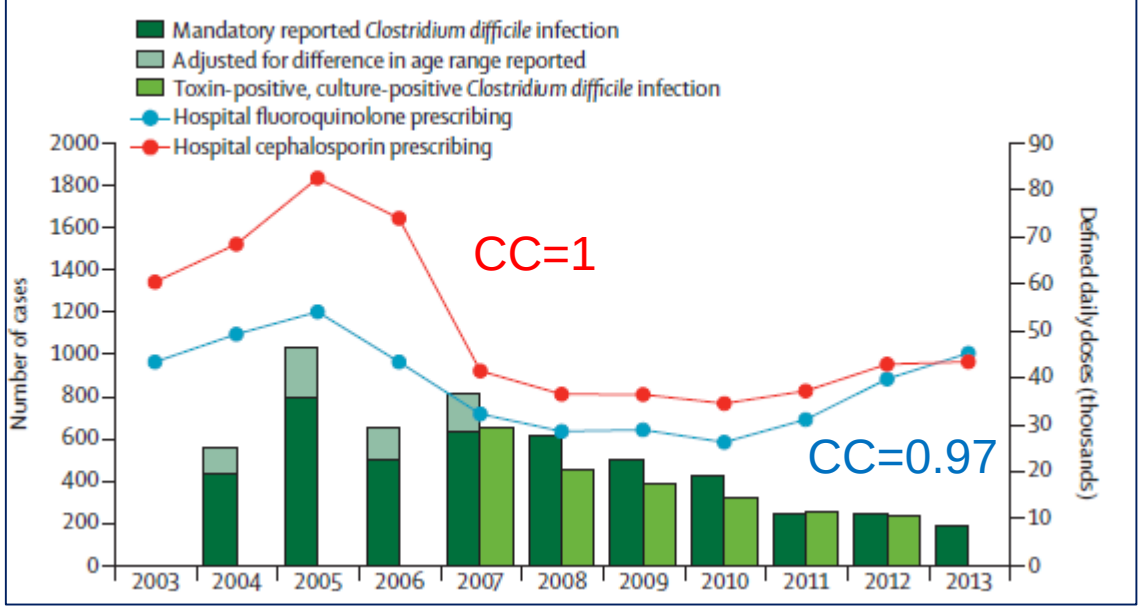

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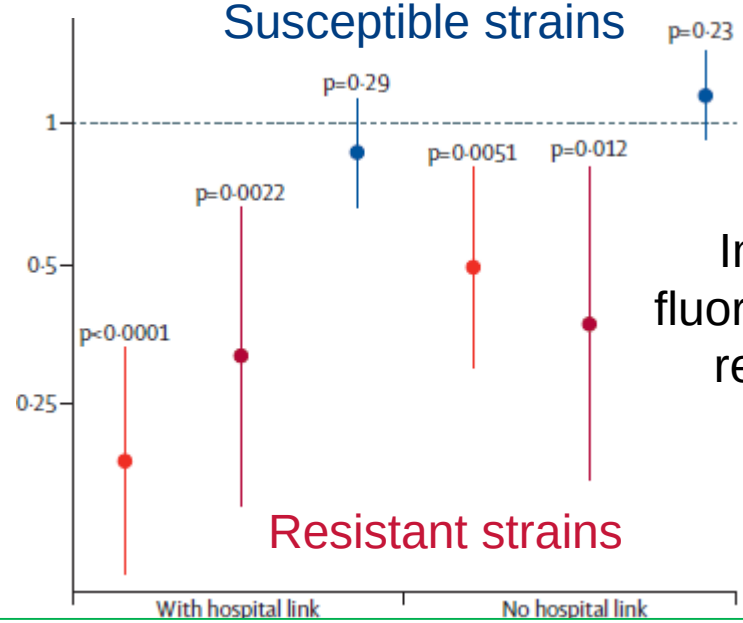

Reductions in fluoroquinolone use → ↘ selection of fluoro-resistant *C.diff* → ↘ CDI

Dingle LID 2017

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Antimicrobial stewardship & *C. difficile*

- Things are not so simple… ready for a PhD?
  1. Do fluoroquinolone-susceptible strains have a transmission **advantage** in the community (vs resistant)?
  2. Are infections caused by fluoroquinolone-resistant and susceptible strains mutually exclusive?
  3. Do fluoroquinolone-resistant and susceptible strains differ in their **duration of asymptomatic carriage** in hospital and community settings?

Correspondence

Clostridium difficile in England: can we stop washing our hands?

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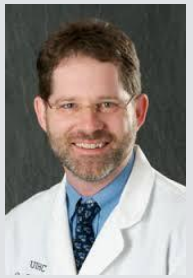

Summary

Wherein I reveal the top 3 approaches for preventing *C. difficile* disease!

1. Dingle, et al. Lancet Infect Dis 2017 → Antibiotic stewardship
2. Anderson, et al. Lancet 2017 → Antibiotic stewardship
3. Widmer, et al. Clin Infect Dis 2017 → Antibiotic stewardship

"To sum up: assuming I have a limited budget with which to reduce CDI, I'd be wise to invest most of it in active antibiotic stewardship."

http://haicontroversies.blogspot.com/2017/03/wherein-i-reveal-top-3-approaches-for.html

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3. Surgical site infections
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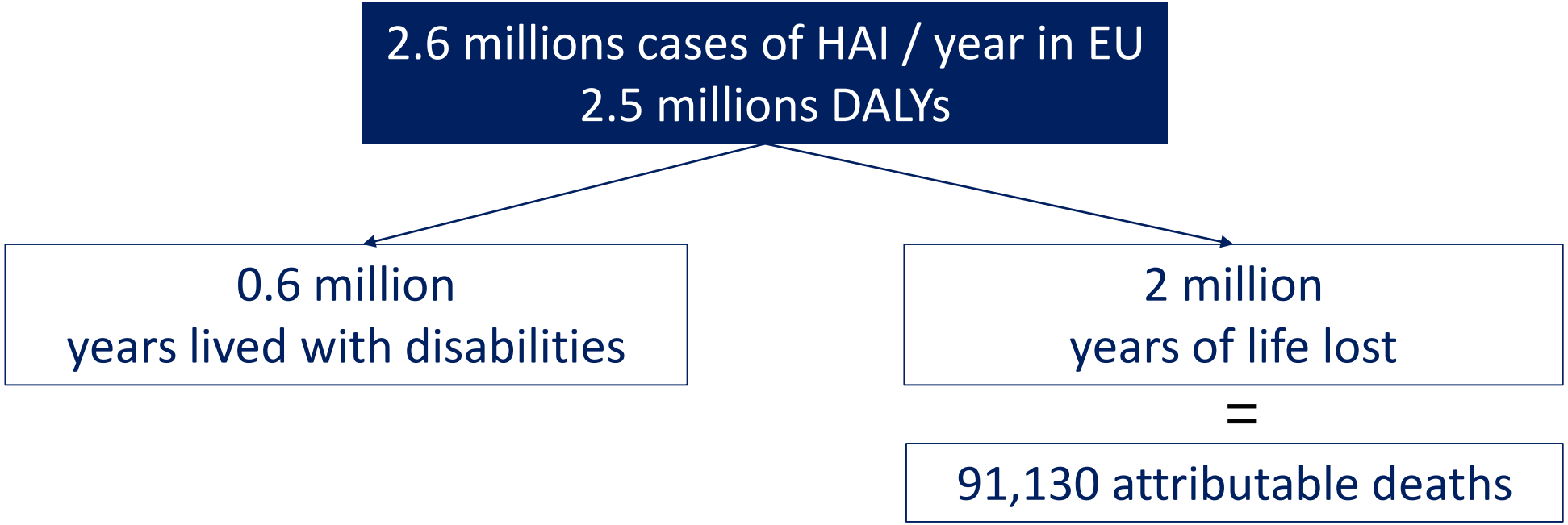
Epidemiology of HCAI

- Burden of HAIs in acute care hospitals of EU/EEA
  - Data source: Incidences derived from ECDC point prevalence survey 2012
  - Method: BCoDE project (syndrome-based approach) → DALY



Cassini Plos Med 2016

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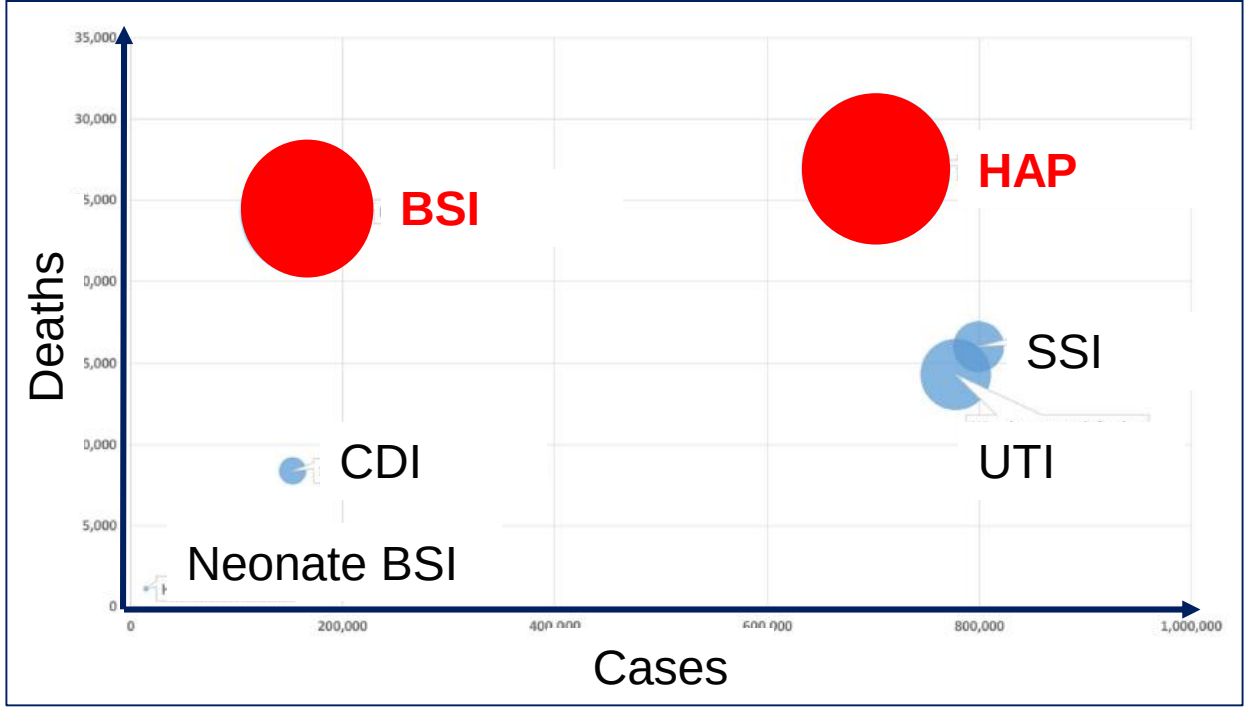
Epidemiology of HCAI

56% of attributable deaths attributable to HAP and HA primary BSIs



	Incidence
1	SSI
2	UTI
3	HAP
4	BSI
5	CDI
6	Neonate BSI

DALY/100,000	
HAP	1
BSI	2
UTI	3
SSI	4
CDI	5
Neonate BSI	6

Burden of HAP (169 DALYs per 100,000)
> 1/3 of the all LRTIs burden

Cassini Plos Med 2016

Agenda

Prevention of

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5. Hospital outbreaks

Impregnated catheters & BSI: CATCH Trial

- Objective: Effectiveness of impregnation (antibiotic or heparin) vs standard CVC to prevent BSI in children
- Design: Randomised controlled trial, assignement (1:1:1), 2010-2012
- Setting: 14 English paediatric ICU
- Types of CVC: polyurethane
  - Impregnated with minocycline + rifampicin
  - Impregnated with Heparin + benzalkonium chloride
- Outcomes:
  - Time to 1st BSI > 48 h after randomisation < 48 h CVC removal
  - Same organisms cultured from blood and the CVC tip

Gilbert Lancet 2016

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Impregnated catheters & BSI: CATCH Trial

Standard CVC	Antibiotic CVC	Heparin CVC
502 included in intention-to-treat **18 (4%) BSI** **CLABSI: 12 (2%)**	486 included in intention-to-treat **7 (1%) BSI** **CLABSI: 3 (<1%)**	497 included in intention-to-treat **17 (3%) BSI** **CLABSI: 10 (2%)**

Gilbert Lancet 2016

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Hazard ratio (95% CI)	1st BSI	CLABSI
Impregnated vs standard	0.7 (0.4 – 1.3), p=0.3	0.5 (0.2 – 1.2) , p=0.1
ATB vs standard	**0.4 (0.2 – 0.9), p=0.04**	**0.2 (0.07 – 0.9), p=0.03**
Heparin vs standard	1 (0.5 – 2), p=0.9	0.8 (0.4 – 1.9), p=0.68
ATB vs heparin	**0.4 (0.2 – 0.9), p=0.03**	0.3 (0.08 – 1.1), p=0·09

Gilbert Lancet 2016

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ATB vs heparin	**0.4 (0.2 – 0.9), p=0.03**	0.3 (0.08 – 1.1), p=0·09

- ATB impregnation ↘ BSI by 57% vs standard & 58% vs Heparin
- No impact on 30 days mortality

Gilbert Lancet 2016

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Bundle compliance & CLABSI

- Compliance with the central line insertion bundle overall and with individual bundle elements and there impact
- 984 adult ICUs, 98% with CL bundle policies
  - 20% ICUs reported excellent & full compliance, 49% at least usually (≥75%)

CLABSI bundle elements	Compliance all of the Time (≥95%)	IRR (95% CI)
All 5 elements	192 (19.5)	0.67 (0.59–0.77)
4 elements	194 (19.7)	0.72 (0.63–0.82)
3 elements	155 (15.8)	0.83 (0.74–0.94)
2 elements	73 (7.4)	0.82 (0.70–0.95)
1 element	61 (6.2)	0.77 (0.64–0.92)

No association between CLABSI rates and having written CL bundle policy nor with bundle compliance <75%

Furuya ICHE 2016

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Prevention of CAUTI in Acute care

- Objective: Implementation of the national Comprehensive Unit-based Safety Program (CUSP) to reduce CAUTI
- Setting: 926 units (59.7% non-ICU) in 603 hospitals in 32 states

Interventions
1. Daily assessment of presence/necessity 2. Alternatives to urinary catheters 3. Aseptic technique insertion/maintenance 4. Feedback on CAUTI rates 5. Training and identification of gaps → Possibility of adaptation

Saint NEJM 2016

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→ Possibility of adaptation

Implementation strategy

- Sponsorship/collaboration with national societies/agencies (ie AHRQ)
- Centralized coordination/dissemination
- Guidance on technical practices: tools, manuals, checklists, implementation guide
- **Emphasis on socioadaptive factors**

Saint NEJM 2016

Imperial College London

Prevention of CAUTI in Acute care

- Objective: Implementation of the national Comprehensive Unit-based Safety Program (CUSP) to reduce CAUTI
- Setting: 926 units (59.7% non-ICU) in 603 hospitals in 32 states

Interventions

1. Daily assessment of presence/necessity
2. Alternatives to urinary catheters
3. Aseptic technique insertion/maintenance
4. Feedback on CAUTI rates
5. Training and identification of gaps

→ Possibility of adaptation

Implementation strategy

- Sponsorship/collaboration with national societies/agencies (ie AHRQ)
- Centralized coordination/dissemination
- Guidance on technical practices: tools, manuals, checklists, implementation guide
- **Emphasis on socioadaptive factors**

Number of CAUTI / 1000 catheter-days

Proportion of patients with indwelling urinary catheters

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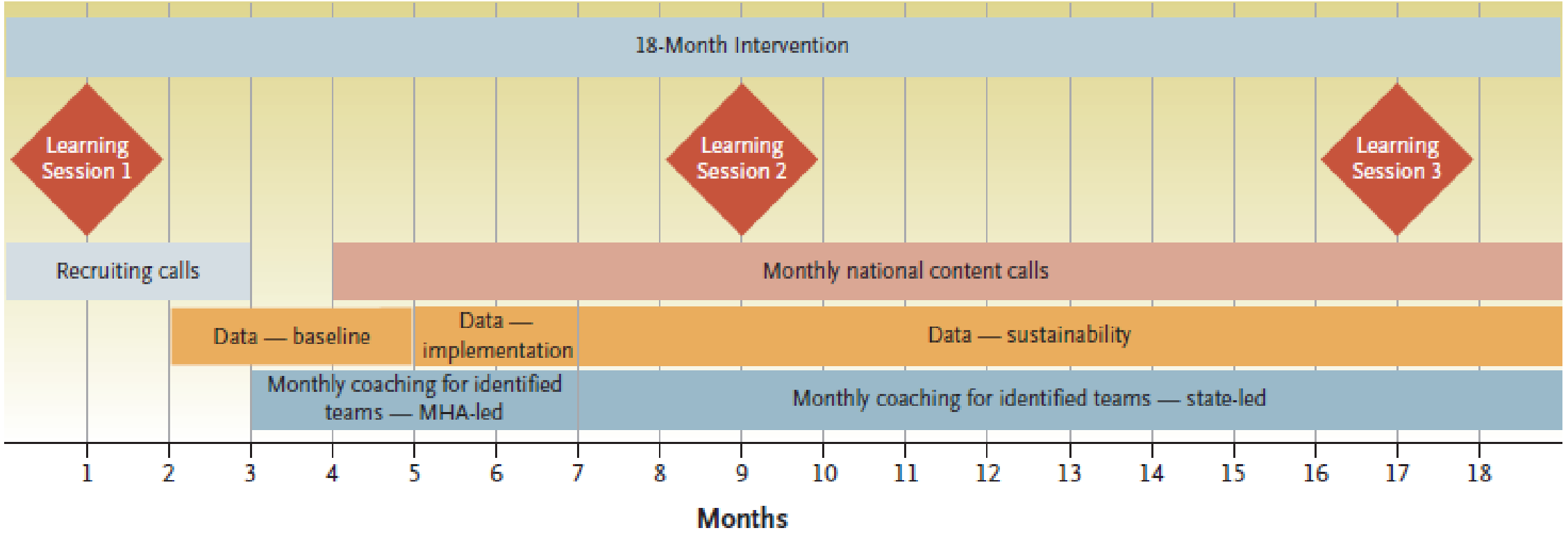
Prevention of CAUTI in Acute care



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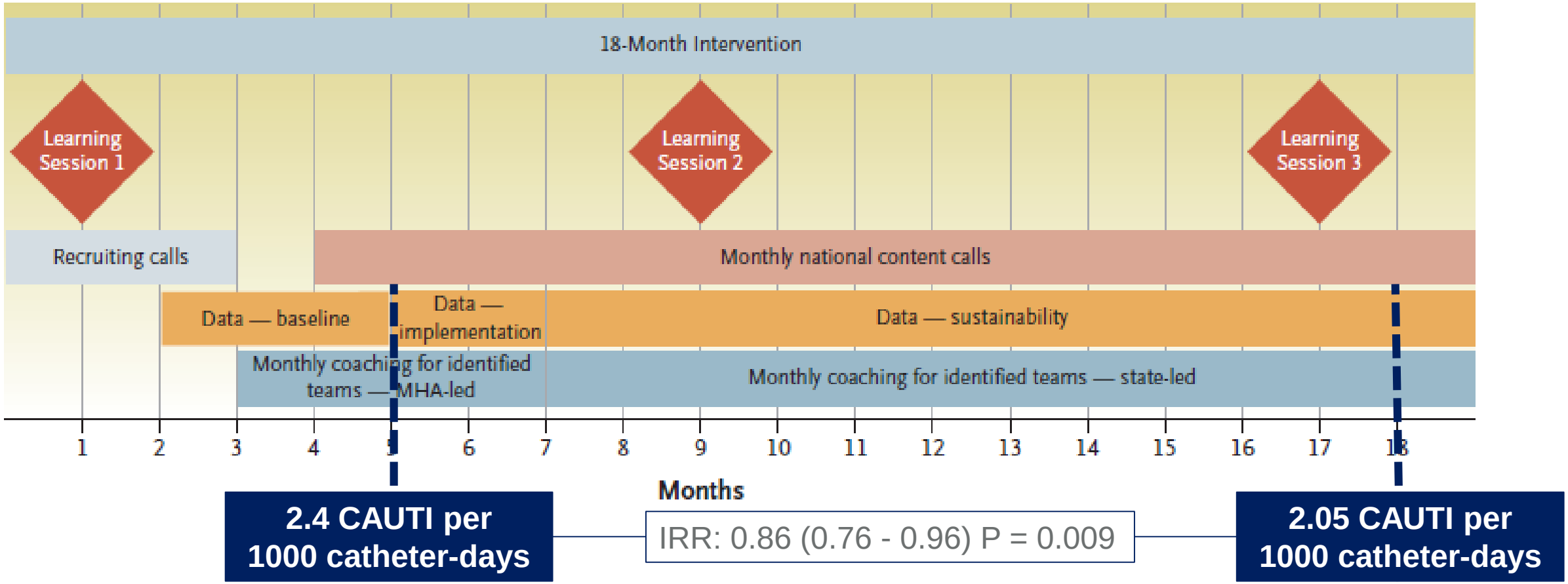
Prevention of CAUTI in Acute care



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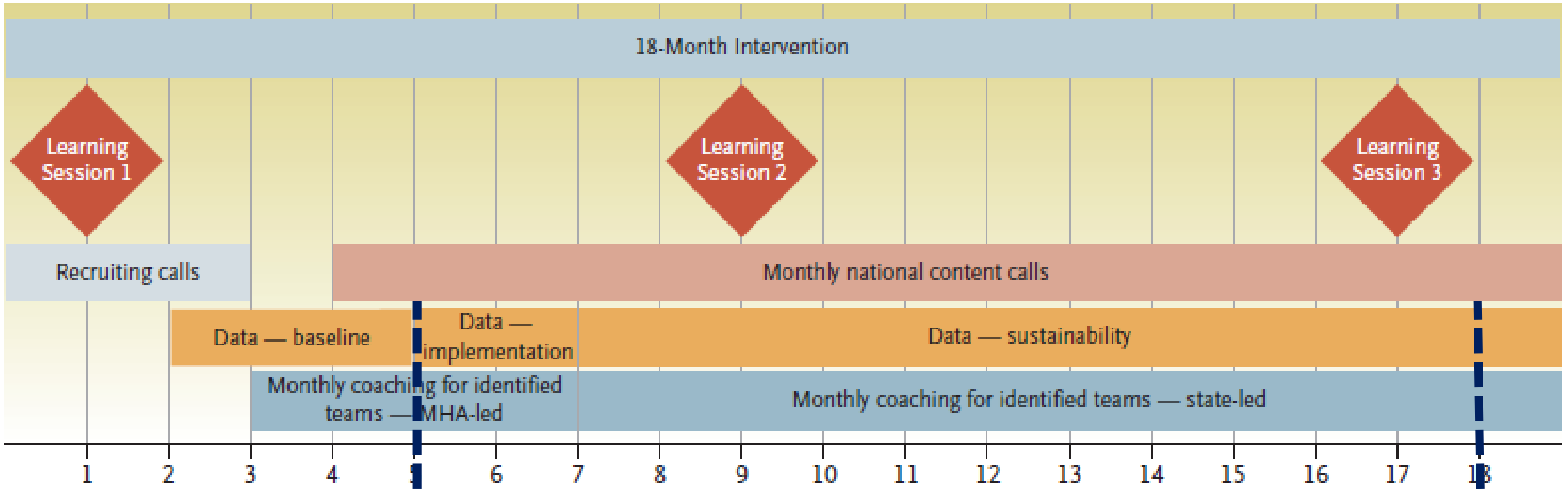
Prevention of CAUTI in Acute care



2.4 CAUTI per 1000 catheter-days

IRR: 0.86 (0.76 - 0.96) P = 0.009

2.05 CAUTI per 1000 catheter-days

20.1% Catheter use

IRR: 0.93 (0.90 - 0.96) P < 0.001

18.8% Catheter use

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Prevention of CAUTI in Acute care

	CAUTI rates		Catheter use	
	Non-ICU	ICU	Non-ICU	ICU
Time	0.68 (0.56–0.82)	1.01 (0.87–1.17)	0.93 (0.90–0.96)	0.98 (0.96–1.01)
Teaching hospital	1.76 (1.03–3.01)	1.92 (1.32–2.80)	0.96 (0.73–1.26)	0.96 (0.88–1.06)
Rural hospital	0.90 (0.66–1.23)	0.83 (0.58–1.18)	0.89 (0.78–1.01)	0.85 (0.78–0.91)
Critical-access hospital	2.36 (1.65–3.37)	2.60 (0.94–7.20)	0.95 (0.82–1.10)	0.81 (0.67–0.98)
Hospital size (per 100-bed increase)	0.97 (0.90–1.05)	1.09 (1.02–1.16)	0.98 (0.95–1.02)	1.02 (1.01–1.04)

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Prevention of CAUTI in Acute care

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- Non-ICUs benefited from participating in the program, whereas ICUs did not
- In ICU:
  - close monitoring of urine output
  - routine culturing of various body fluids

Saint NEJM 2016

Agenda

Prevention of

1. *Clostridium difficile* infections
2. Catheters associated infections
3. Surgical site infections
4. Healthcare associated Pneumonia
5. Emerging issues

Imperial College London

New guidelines

Series

Surgical site infections 1

New WHO recommendations on preoperative measures for surgical site infection prevention: an evidence-based global perspective

Benedetta Allegranzi, Peter Bischoff, Stijn de Jonge, N Zeynep Kubilay, Bassim Zayed, Stacey M Gomes, Mohamed Abbas, Jasper J Atema, Sarah Gans, Miranda van Rijen, Marja A Boermeester, Matthias Egger, Jan Kluytmans, Didier Pittet, Joseph S Solomkin, and the WHO Guidelines Development Group*

World Health Organization

Series

Surgical site infections 2

New WHO recommendations on intraoperative and postoperative measures for surgical site infection prevention: an evidence-based global perspective

Benedetta Allegranzi, Bassim Zayed, Peter Bischoff, N Zeynep Kubilay, Stijn de Jonge, Fleur de Vries, Stacey M Gomes, Sarah Gans, Elon D Wallert, Xiuwen Wu, Mohamed Abbas, Marja A Boermeester, E Patchen Dellinger, Matthias Egger, Petra Gastmeier, Xavier Guirao, Jianan Ren, Didier Pittet, Joseph S Solomkin, and the WHO Guidelines Development Group

Surgical site infections (SSIs) are the most common health-care-associated infections in developing countries, but they also represent a substantial epidemiological burden in high-income countries. The prevention of these infections is complex and requires the integration of a range of preventive measures before, during, and after surgery. No international guidelines are available and inconsistencies in the interpretation of evidence and recommendations in national guidelines have been identified. Considering the prevention of SSIs as a priority for patient safety, WHO has developed evidence-based and expert consensus-based recommendations on the basis of an extensive list of preventive measures. We present in this Review 16 recommendations specific to the intraoperative and postoperative periods. The WHO recommendations were developed with a global perspective and they take into account the balance between benefits and harms, the evidence quality level, cost and resource use implications, and patient values and preferences.

Lancet Infect Dis 2016; 16: e288–303
Published Online November 2, 2016
http://dx.doi.org/10.1016/S1473-3099(16)30403-9
See Series page e276
This is the second in a Series of two papers about surgical site infections

Clinical Review & Education

JAMA Surgery | Special Communication

Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection, 2017

Sandra I. Berrios-Torres, MD; Craig A. Umscheid, MD, MSCE; Dale W. Bratzler, DO, MPH; Brian Leas, MA, MS; Erin C. Stone, MA; Rachel R. Kelz, MD, MSCE; Caroline E. Reinke, MD, MSHP; Sherry Morgan, RN, MLS, PhD; Joseph S. Solomkin, MD; John E. Mazuski, MD, PhD; E. Patchen Dellinger, MD; Kamal M. F. Itani, MD; Elie F. Berbari, MD; John Segreti, MD; Javad Parvizi, MD; Joan Blanchard, MSS, BSN, RN, CNOR, CIC; George Allen, PhD, CIC, CNOR; Jan A. J. W. Kluytmans, MD; Rodney Donlan, PhD; William P. Schecter, MD; for the Healthcare Infection Control Practices Advisory Committee

Invited Commentary
Supplemental content

IMPORTANCE The human and financial costs of treating surgical site infections (SSIs) are increasing. The number of surgical procedures performed in the United States continues to rise, and surgical patients are initially seen with increasingly complex comorbidities. It is estimated that approximately half of SSIs are deemed preventable using evidence-based strategies.

OBJECTIVE To provide new and updat
prevention of SSI.

EVIDENCE REVIEW A targeted system
EMBASE, CINAHL, and the Cochrane L
Grading of Recommendations, Assess
was used to assess the quality of evide
and to provide explicit links between t
literature searches, 5759 titles and ab
review by 2 independent reviewers. A
evidence, evaluated, and categorized.

FINDINGS Before surgery, patients sho
(antimicrobial or nonantimicrobial) or
operative day. Antimicrobial prophyla

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Accepted Manuscript

American College of Surgeons and Surgical Infection Society: Surgical Site Infection Guidelines, 2016 Update

Kristen A. Ban, MD, Joseph P. Minei, MD, FACS, Christine Laronga, MD, FACS, Brian G. Harbrecht, MD, FACS, Eric H. Jensen, MD, FACS, Donald E. Fry, MD, FACS, Kamal MF. Itani, MD, FACS, E Patchen Dellinger, MD, FACS, Clifford Y. Ko, MD, MS, MSHS, FACS, Therese M. Duane, MD, MBA, FACS

PII: S1072-7515(16)31563-0
DOI: 10.1016/j.jamcollsurg.2016.10.029
Reference: ACS 8512
To appear in: *Journal of the American College of Surgeons*
Received Date: 27 September 2016
Accepted Date: 5 October 2016

Journal of the American College of Surgeons

Imperial College London

New guidelines

WHO: 27 meta-analysis of RCT performed

Systematic Review and Meta-Analysis

Medicine

OPEN

A systematic review and meta-analysis including GRADE qualification of the risk of surgical sit infections after prophylactic negative pressu wound therapy compared with conventional dressings in clean and contaminated surgery

Fleur E.E. De Vries, MD[a,*], Elon D. Wallert, BSc[a], Joseph S. Solomkin, MD[b], Benedetta Allegranzi, M Matthias Egger, PhD[d], E. Patchen Dellinger, MD[e], Marja A. Boermeester, MD[a]

Abstract

Objective: Systematically review and Grading of Recommendations Assessment, Development, and Evaluation (GR on prophylactic negative pressure wound therapy (pNPWT) to prevent surgical site infections (SSIs).

Introduction: pNPWT has been suggested as a new method to prevent wound complications, specifically SSIs, by on closed incisional wounds.

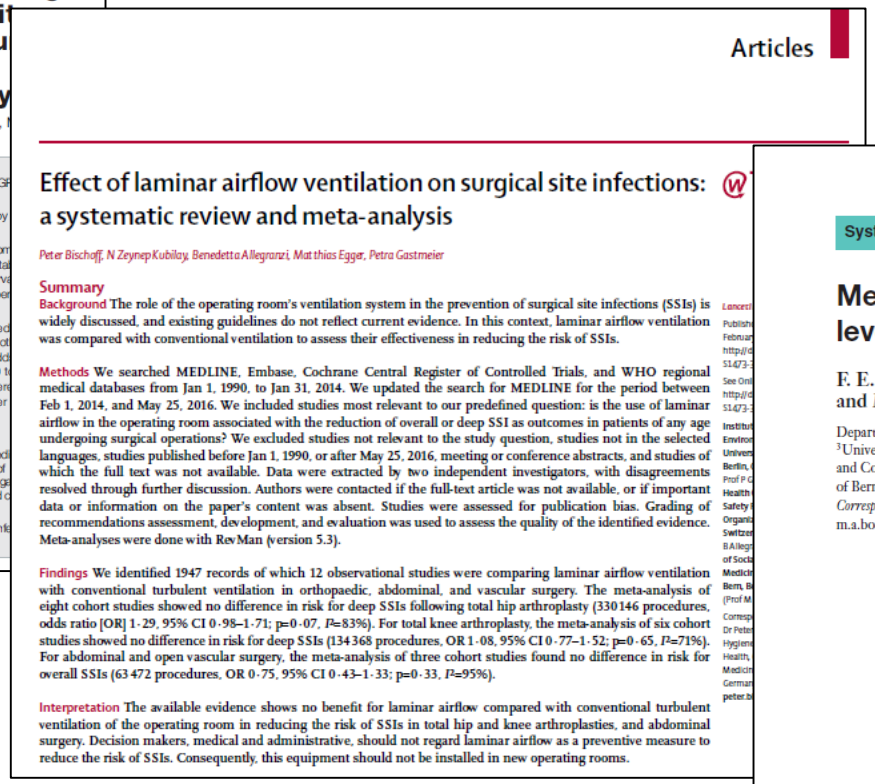
Methods: This review was conducted as part of the development of the Global Guidelines for prevention of SSIs con World Health Organization in Geneva. PubMed, Embase, CENTRAL, CINAHL, and the World Health Organization datal January 1, 1990 and October 7, 2015 were searched. Inclusion criteria were randomized controlled trials and observe comparing pNPWT with conventional wound dressings and reporting on the incidence of SSI. Meta-analyses were per random effect model. GRADE Pro software was used to qualify the evidence.

Results: Nineteen articles describing 21 studies (6 randomized controlled trials and 15 observational) were included Summary estimate showed a significant benefit of pNPWT over conventional wound dressings in reducing SSIs in bot controlled trials and observational studies, odds ratio of 0.56 (95% confidence interval, 0.32–0.96; $P = 0.04$) and odd (95% confidence interval, 0.22–0.42; $P < 0.00001$), respectively. This translates into lowering the SSI rate from 140 t per 1000 patients and from 106 to 34 (25–47) per 1000 patients, respectively. In stratified analyses, these results were both clean and clean-contaminated procedures and in different types of surgery, however results were no longer orthopaedic/trauma surgery. The level of evidence as qualified with GRADE was however low.

Conclusions: Low-quality evidence indicates that prophylactic NPWT significantly reduces the risk of SSIs.

Abbreviations: CINAHL=Cumulative Index to Nursing and Allied Health Literature, EMBASE=Excerpta Medi GRADE=Grading of Recommendations Assessment, Development, and Evaluation, MOOSE=meta-analysis of studies in epidemiology, NPWT=negative pressure wound therapy, OR=odds ratio, pNPWT=prophylactic nega wound therapy, PRISMA=Preferred Reporting Items for Systematic Review and Meta-Analysis, RCT=randomized c SSI=surgical site infections, WHO=World Health Organization.

Keywords: incisional wound therapy, prevention, prophylactic negative pressure wound therapy, surgical site inf infections



Articles

Effect of laminar airflow ventilation on surgical site infections: a systematic review and meta-analysis

Peter Bischoff, N Zeynep Kubilay, Benedetta Allegranzi, Matthias Egger, Petra Gastmeier

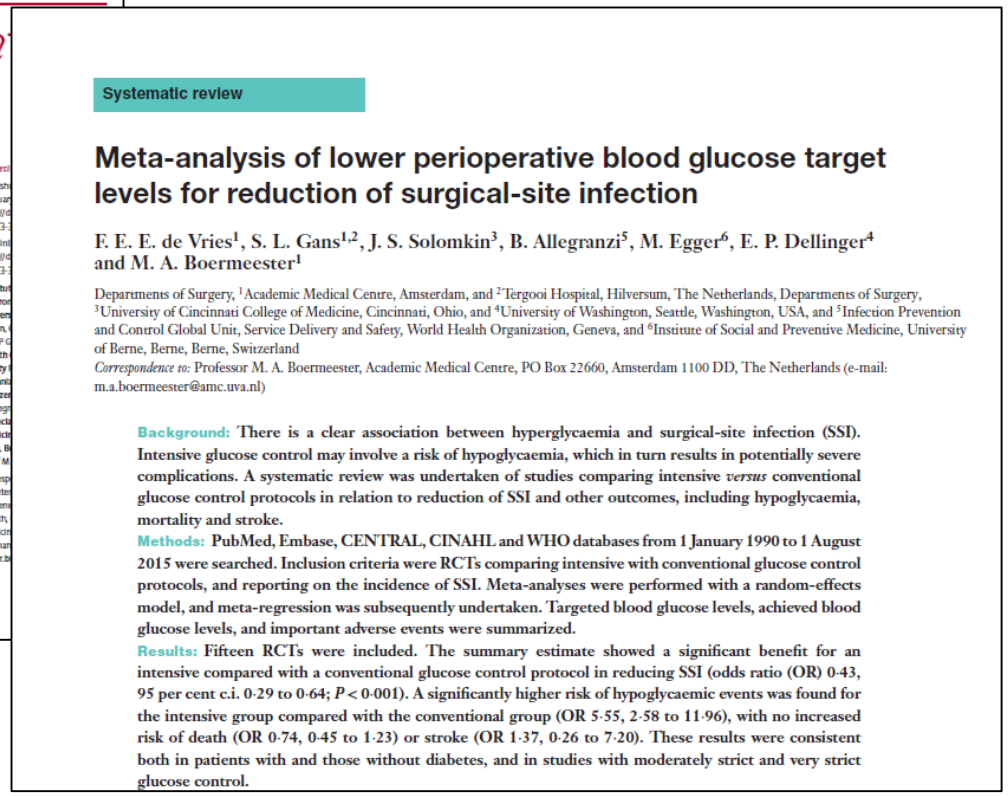
Summary

Background The role of the operating room's ventilation system in the prevention of surgical site infections (SSIs) is widely discussed, and existing guidelines do not reflect current evidence. In this context, laminar airflow ventilation was compared with conventional ventilation to assess their effectiveness in reducing the risk of SSIs.

Methods We searched MEDLINE, Embase, Cochrane Central Register of Controlled Trials, and WHO regional medical databases from Jan 1, 1990, to Jan 31, 2014. We updated the search for MEDLINE for the period between Feb 1, 2014, and May 25, 2016. We included studies most relevant to our predefined question: is the use of laminar airflow in the operating room associated with the reduction of overall or deep SSI as outcomes in patients of any age undergoing surgical operations? We excluded studies not relevant to the study question, studies not in the selected languages, studies published before Jan 1, 1990, or after May 25, 2016, meeting or conference abstracts, and studies of which the full text was not available. Data were extracted by two independent investigators, with disagreements resolved through further discussion. Authors were contacted if the full-text article was not available, or if important data or information on the paper's content was absent. Studies were assessed for publication bias. Grading of recommendations assessment, development, and evaluation was used to assess the quality of the identified evidence. Meta-analyses were done with RevMan (version 5.3).

Findings We identified 1947 records of which 12 observational studies were comparing laminar airflow ventilation with conventional turbulent ventilation in orthopaedic, abdominal, and vascular surgery. The meta-analysis of eight cohort studies showed no difference in risk for deep SSIs following total hip arthroplasty (330 146 procedures, odds ratio [OR] 1·29, 95% CI 0·98–1·71; p=0·07, I^2=83%). For total knee arthroplasty, the meta-analysis of six cohort studies showed no difference in risk for deep SSIs (134 368 procedures, OR 1·08, 95% CI 0·77–1·52; p=0·65, I^2=71%). For abdominal and open vascular surgery, the meta-analysis of three cohort studies found no difference in risk for overall SSIs (63 472 procedures, OR 0·75, 95% CI 0·43–1·33; p=0·33, I^2=95%).

Interpretation The available evidence shows no benefit for laminar airflow compared with conventional turbulent ventilation of the operating room in reducing the risk of SSIs in total hip and knee arthroplasties, and abdominal surgery. Decision makers, medical and administrative, should not regard laminar airflow as a preventive measure to reduce the risk of SSIs. Consequently, this equipment should not be installed in new operating rooms.



Systematic review

Meta-analysis of lower perioperative blood glucose target levels for reduction of surgical-site infection

F. E. E. de Vries[1], S. L. Gans[1,2], J. S. Solomkin[3], B. Allegranzi[5], M. Egger[6], E. P. Dellinger[4] and M. A. Boermeester[1]

Departments of Surgery, [1]Academic Medical Centre, Amsterdam, and [2]Tergooi Hospital, Hilversum, The Netherlands, Departments of Surgery, [3]University of Cincinnati College of Medicine, Cincinnati, Ohio, and [4]University of Washington, Seattle, Washington, USA, and [5]Infection Prevention and Control Global Unit, Service Delivery and Safety, World Health Organization, Geneva, and [6]Insitute of Social and Preventive Medicine, University of Berne, Berne, Switzerland

Correspondence to: Professor M. A. Boermeester, Academic Medical Centre, PO Box 22660, Amsterdam 1100 DD, The Netherlands (e-mail: m.a.boermeester@amc.uva.nl)

Background: There is a clear association between hyperglycaemia and surgical-site infection (SSI). Intensive glucose control may involve a risk of hypoglycaemia, which in turn results in potentially severe complications. A systematic review was undertaken of studies comparing intensive *versus* conventional glucose control protocols in relation to reduction of SSI and other outcomes, including hypoglycaemia, mortality and stroke.

Methods: PubMed, Embase, CENTRAL, CINAHL and WHO databases from 1 January 1990 to 1 August 2015 were searched. Inclusion criteria were RCTs comparing intensive with conventional glucose control protocols, and reporting on the incidence of SSI. Meta-analyses were performed with a random-effects model, and meta-regression was subsequently undertaken. Targeted blood glucose levels, achieved blood glucose levels, and important adverse events were summarized.

Results: Fifteen RCTs were included. The summary estimate showed a significant benefit for an intensive compared with a conventional glucose control protocol in reducing SSI (odds ratio (OR) 0·43, 95 per cent c.i. 0·29 to 0·64; $P < 0·001$). A significantly higher risk of hypoglycaemic events was found for the intensive group compared with the conventional group (OR 5·55, 2·58 to 11·96), with no increased risk of death (OR 0·74, 0·45 to 1·23) or stroke (OR 1·37, 0·26 to 7·20). These results were consistent both in patients with and those without diabetes, and in studies with moderately strict and very strict glucose control.

New guidelines: where they cut…

- **Decolonisation** with mupirocin +/- CHG body wash in *S. aureus* nasal carriers undergoing surgery, whatever the type of procedure
- **Glucose control** (<200 mg/dL) for diabetic and nondiabetic patients (CDC)
- Alcohol-based antiseptic solutions based on **CHG** for skin preparation
- **80% FiO2** intraoperatively and, if feasible, in the immediate postoperative **2–6 h**
- Plastic adhesive incise drapes +/- antimicrobial properties should not be used
- Consider **irrigation** of the incisional wound with an aqueous povidone-iodine solution before closure
- Use of **triclosan-coated sutures**, independent of the type of surgery
- **Laminar airflow ventilation** systems should not be used
- Stopping ATBP once the incision is closed in clean & clean-contaminated procedures (CDC)

Imperial College London

New guidelines: Generated controversies

- **80% FiO2** intraoperatively and, if feasible, in the immediate postoperative 2–6
  - No impact on SSI risk in the recent literature
  - Impractical
  - Concerns regarding harm of hyperoxia

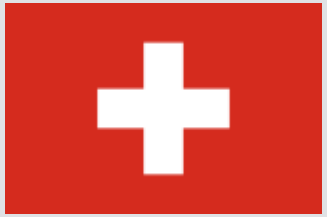
Mellin-Olsen LID 2016

- **Decolonisation** with mupirocin +/- CHG body wash
  - Screening all pre-op less cost-effective than “treat all”
  - Monitoring mupi & CHG-R → timely reconsideration of strategies in case of emergence

https://reflectionsipc.com/2016/11/04/who-guideline-on-ssi-prevention-more-clear-than-feasible/

Imperial College London

Timing of antimicrobial prophylaxis



- Objective: Early vs late administration of cefuroxime before incision
- Design: phase 3 superiority RCT (1:1)
- Setting: 2 university hospitals in Switzerland
- Surgical specialties: general, orthopaedic and vascular
- ATBP procedure: 1.5-3 g Cefuroxime +/- 0.5-1g Metronidazole
  - 30–75 min vs 0–30 min before incision
- Outcomes:
  - Occurrence of any SSI within 30/90 days after surgery (CDC criteria)
  - All cause 30-day mortality and length of hospital stay

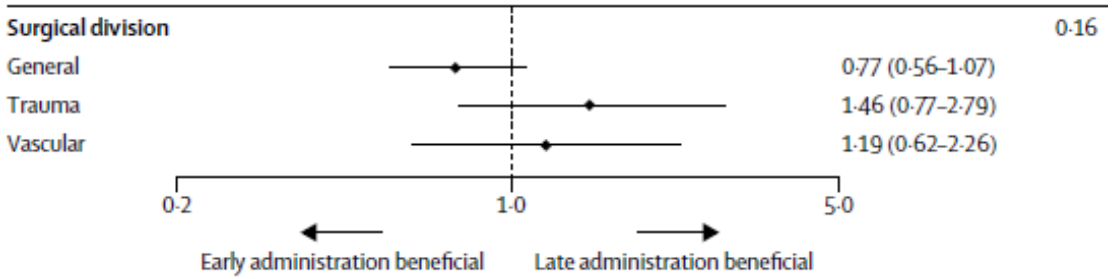
Weber LID 2017

Imperial College London

Timing of antimicrobial prophylaxis

- 2589 in the early and 2586 in the late group

	Early administration	Late administration	Odds ratio, p value
Surgical site infection	113 (5%)	121 (5%)	0.93 (0.72–1.21), p=0.6
Superficial incisional infection	48 (2%)	55 (2%)	0.87 (0.59–1.29), p=0.5
Deep incisional infection	23 (1%)	20 (1%)	1.15 (0.63–2.11), p=0.6
Organ space infection	42 (2%)	46 (2%)	0.91 (0.60–1.39), p=0.7
All-cause 30-day mortality	29 (1%)	24 (1%)	1.21 (0.70–2.09), p=0.5
Median length of hospital stay, days	5.1 (3–9)	5 (3–10)	NA, p=0.375



Early administration did not significantly lower the risk of SSI compared with late administration
Recommendations should stay with a 60 min

Weber LID 2017

Which type of cap in OR?

- Quasi-experimental, before & after study at a single hospital
- Compared surgical site infection rates for all Class I surgical procedures during two 13-month time periods
  - *Period 1:* Surgeon's cap or bouffant cap allowed
  - *Period 2:* Bouffant cap only; surgeon's cap banned
- 16,000 procedures performed during the study

Before

Surgeon's cap allowed

0.77%

After

Bouffant cap only

0.84%

Surgical site infection rates

P= .629

The Bottom Line:

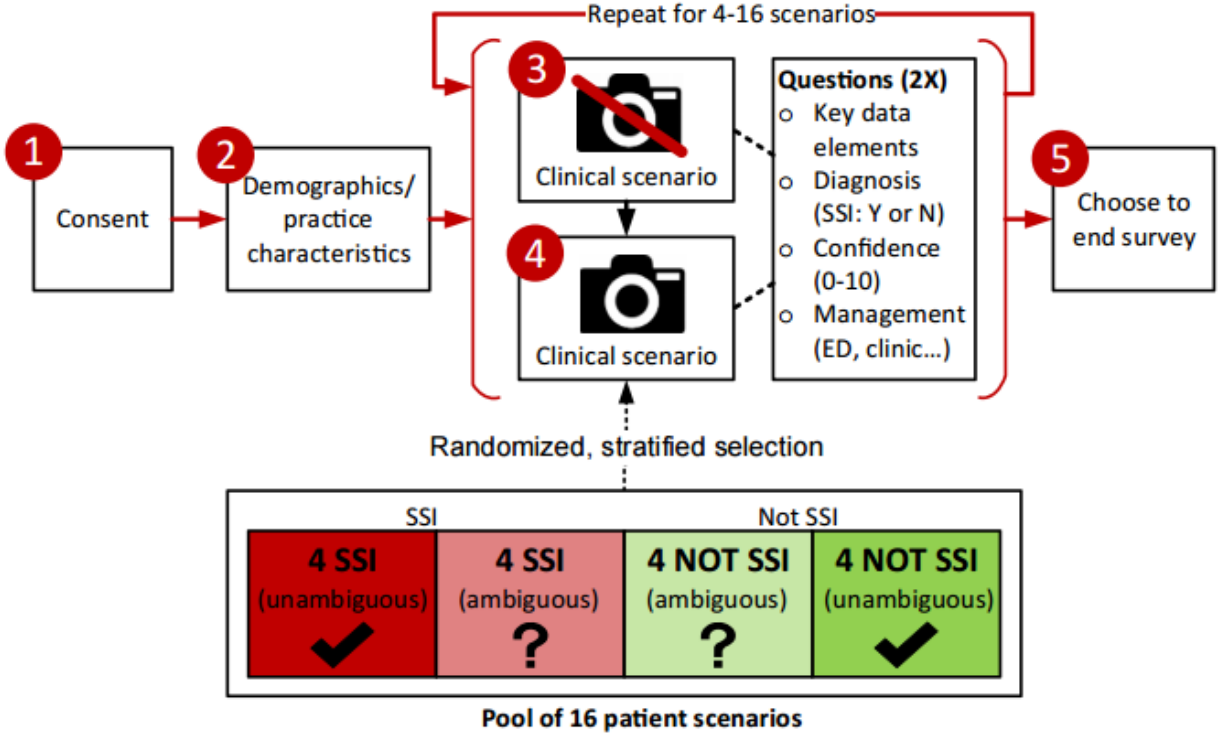
No difference in infection rates based on the type of head coverings worn by OR personnel

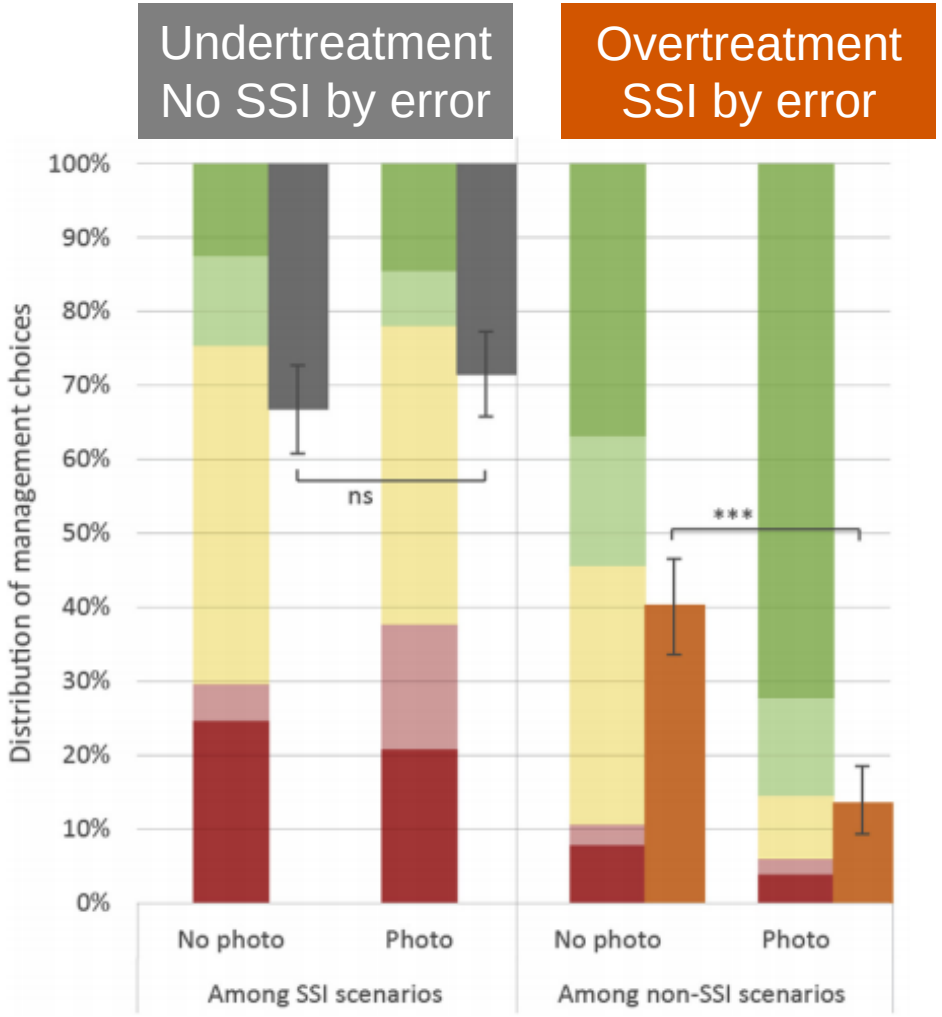
Shallwani Neurosurgery 2017

http://haicontroversies.blogspot.fr/2017/05/the-skullcap-feud-part-2.html

Imperial College London

Patient engagement for surveillance





Sanger J Am Coll Surg 2017

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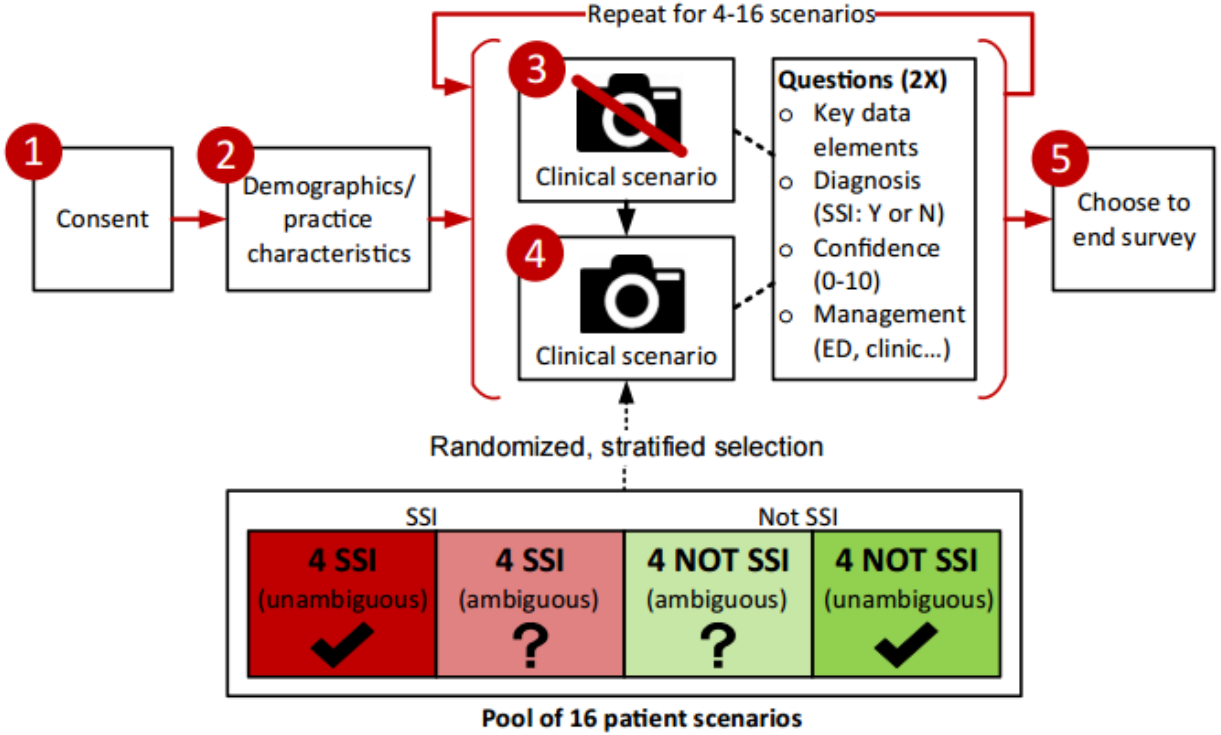
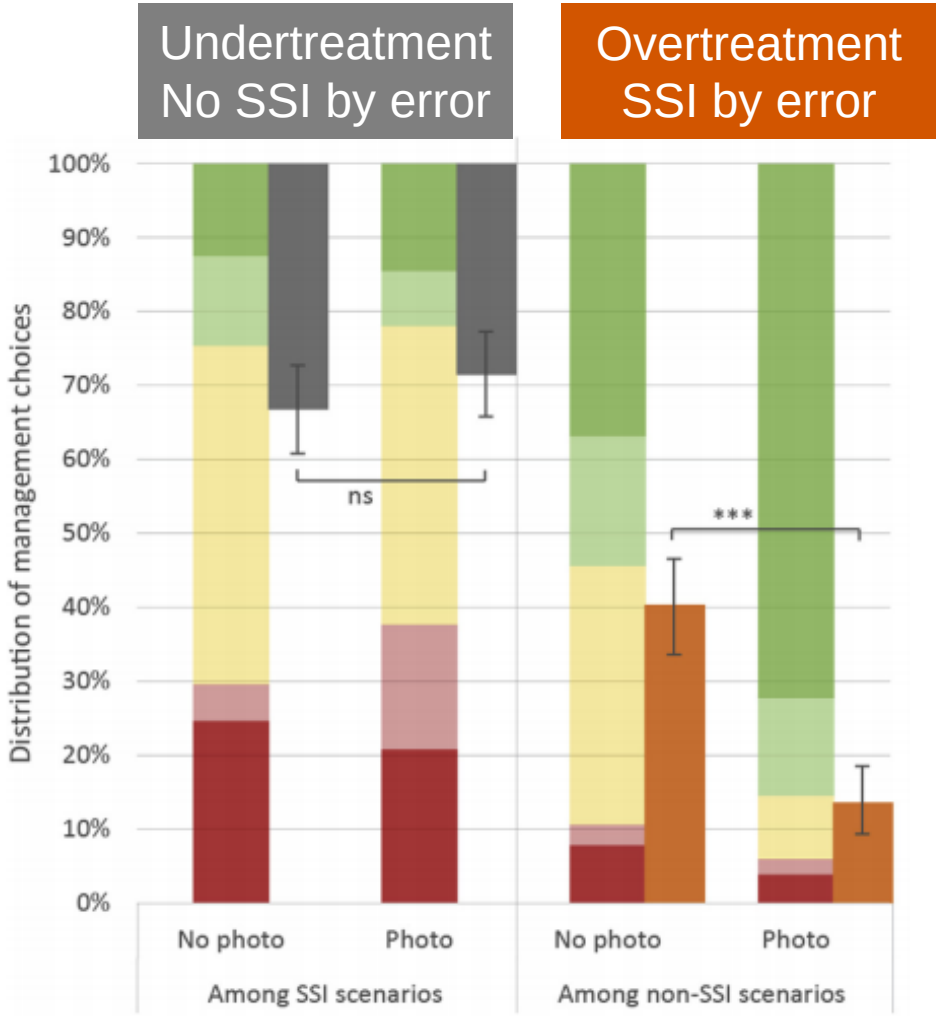
Patient engagement for surveillance



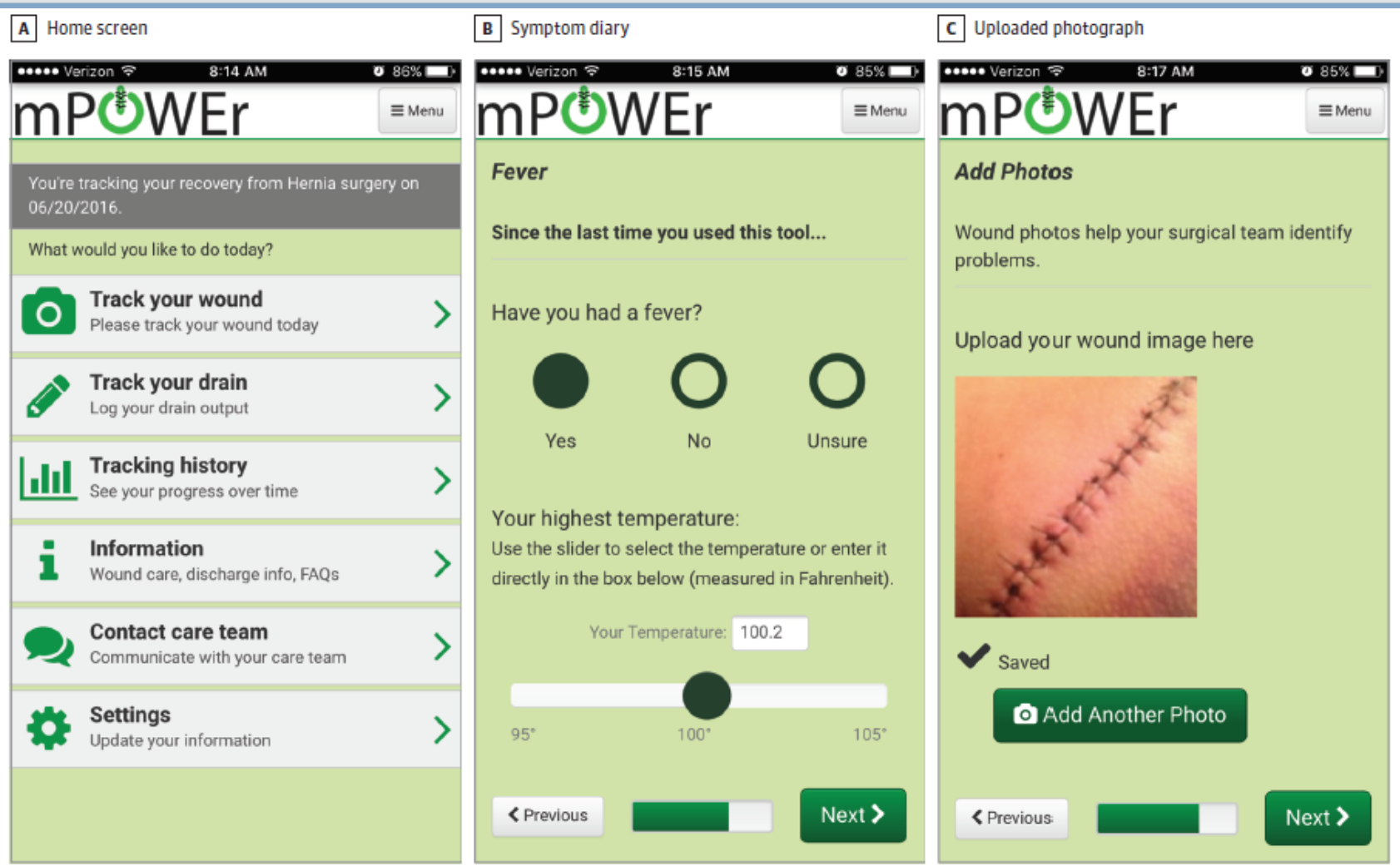


Wound photos may increase the reliability of SSI diagnosis

Sanger J Am Coll Surg 2017

Imperial College London

Patient engagement for surveillance



Evans JAMA surg 2017

Agenda

Prevention of

1. *Clostridium difficile* infections
2. Catheter line associated infections
3. Surgical site infections
4. Healthcare associated Pneumonia
5. Hospital outbreaks

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Bundle compliance & VAP

- Associations between individual and collective ventilator bundle components and ventilator-associated events

HR (95% CI)	VAP	Time to Extubation Alive	Ventilator Mortality
Head-of-bed elevation	1.60 (0.53-4.88)	1.38 (1.14-1.68)	0.86 (0.59-1.25)
Sedative infusion interruptions	0.82 (0.37-1.82)	1.81 (1.54-2.12)	0.51 (0.38-0.68)
Spontaneous breathing trials	0.79 (0.39-1.60)	2.48 (2.23-2.76)	0.28 (0.20-0.38)
Prophylaxis Thromboembolism	1.13 (0.16-7.78)	2.57 (1.80-3.66)	1.39 (0.82-2.37)
Prophylaxis Stress ulcer	7.69 (1.44-41.10)	1.12 (0.95-1.32)	0.91 (0.64-1.31)
Oral care with chlorhexidine	0.55 (0.27-1.14)	0.92 (0.80-1.04)	1.63 (1.15-2.31)

Klompas JAMA Int Med 2016

Imperial College London

Bundle compliance & VAP

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Revision of the classic ventilator bundle:
- Exclusion of oral care from protocols?
- Stress ulcer prophylaxis for patients at risk

Klompas JAMA Int Med 2016

Topics approached

Prevention of

1. *Clostridium difficile* infections
2. Catheters associated infections
3. Surgical site infections
4. Healthcare associated Pneumonia
5. Emerging issues

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Nontuberculous *mycobacterium*: The problem

- National UK investigation to assess risk of invasive *Mycobacterium chimaera* infection in cardiothoracic surgery 2007 - 2015
  - Identification of cardiopulmonary bypass–associated *M. chimaera* infection
  - Microbiological and aerobiological investigations of heater-coolers
  - Whole-genome sequencing of clinical and environmental isolates

Chand CID 2017

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Incidences:
2010: <0.2 case per 10 000 person-years
2013: 1.65 per 10 000 person-years

Chand CID 2017

Nontuberculous *mycobacterium*: The problem

- Clinical characteristics:
  - Mitral (n = 3) or aortic valve replacement (n = 15)
  - Median time between surgery and presentation: 1.15 years (0.25–5.1)
  - Death: n=9 (50%)

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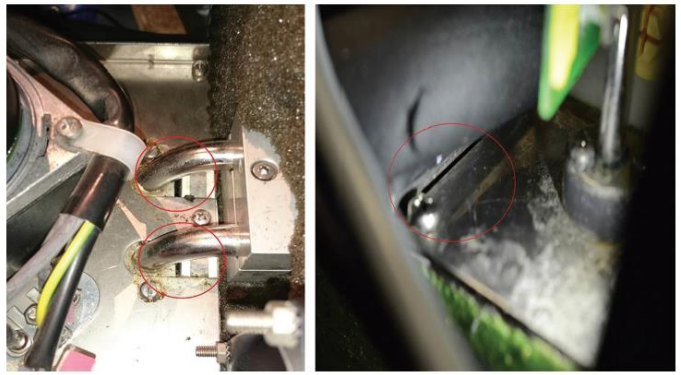
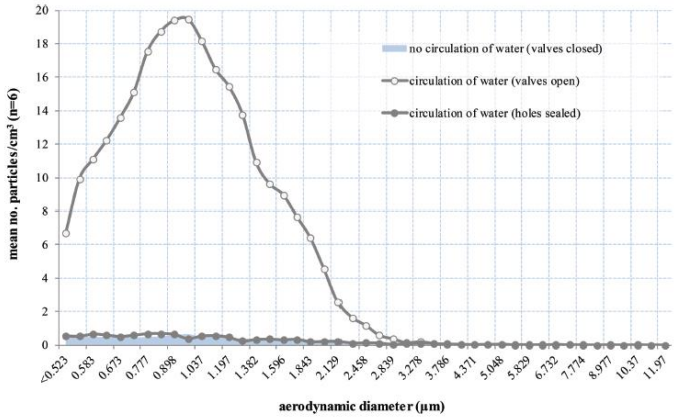
Nontuberculous *mycobacterium*: The problem

- Clinical characteristics:
  - Mitral (n = 3) or aortic valve replacement (n = 15)
  - Median time between surgery and presentation: 1.15 years (0.25–5.1)
  - Death: n=9 (50%)
- Environmental contamination:
  - 35 3T HCUs → 27 (77%) positive for mycobacteria, 17 (48%) for *M. chimaera*
  - 10 CFU/m3 not circulating water → 560 CFU/m3 once water circulating





Chand CID 2017

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Nontuberculous *mycobacterium*: The problem

How big is the iceberg? *(Post 27 March 2017)*

- *"…a case is detected in a given location, after which there is a lot of attention focused on the problem, including media reports and provider notifications…"*
- Current unofficial global case count: **at least 108 (10 countries)**
- We are long overdue for
  - **Mandatory public reporting**
  - **Global registry** to track this outbreak

http://haicontroversies.blogspot.fr/2017/03/mycobacterium-chimaera-how-big-is.html

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Mycobacterium chimaera: The reason

- Technical/microbiological experiments to investigate the potential airborne transmission pathway

Sommerstein EID 2016

Imperial College London

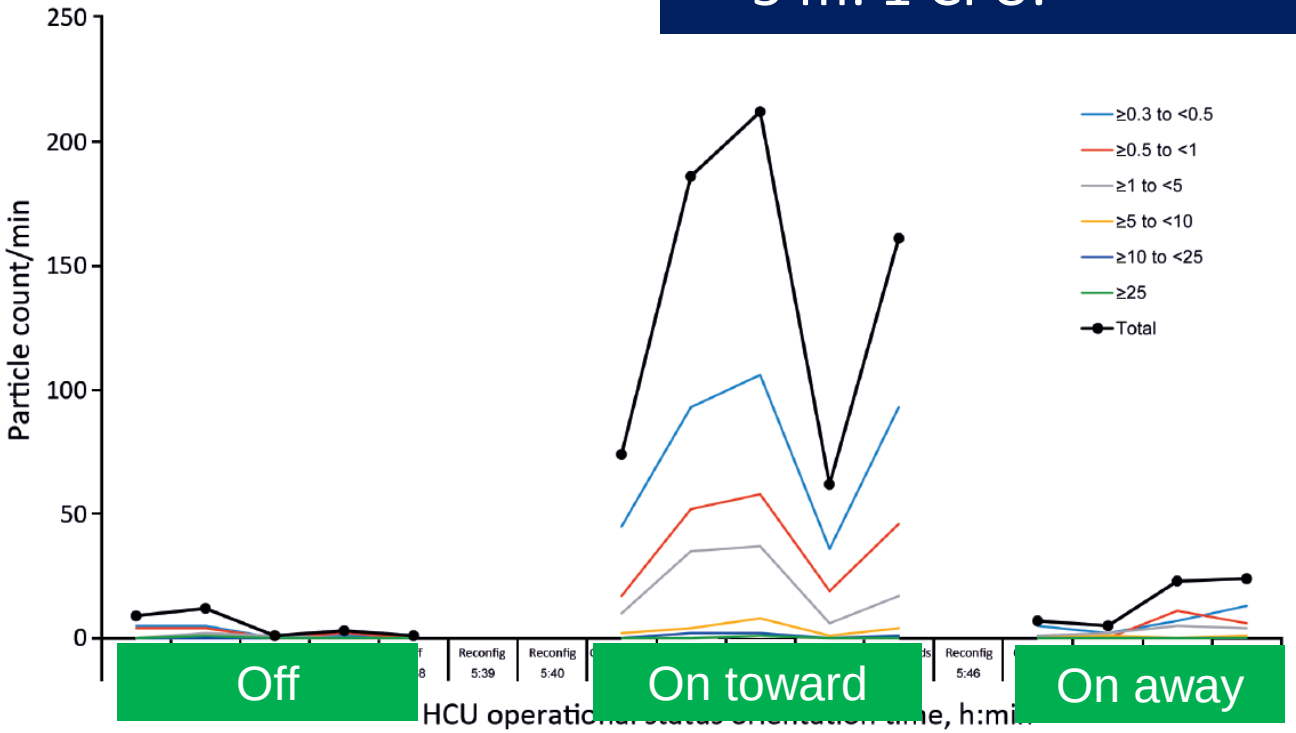
Mycobacterium chimaera: The reason

- Technical/microbiological experiments to investigate the potential airborne transmission pathway

Sommerstein EID 2016

<u>*M. chimaera* at distance from HCU:</u>

- 3 m: 2 CFUs
- 5 m: 1 CFU.



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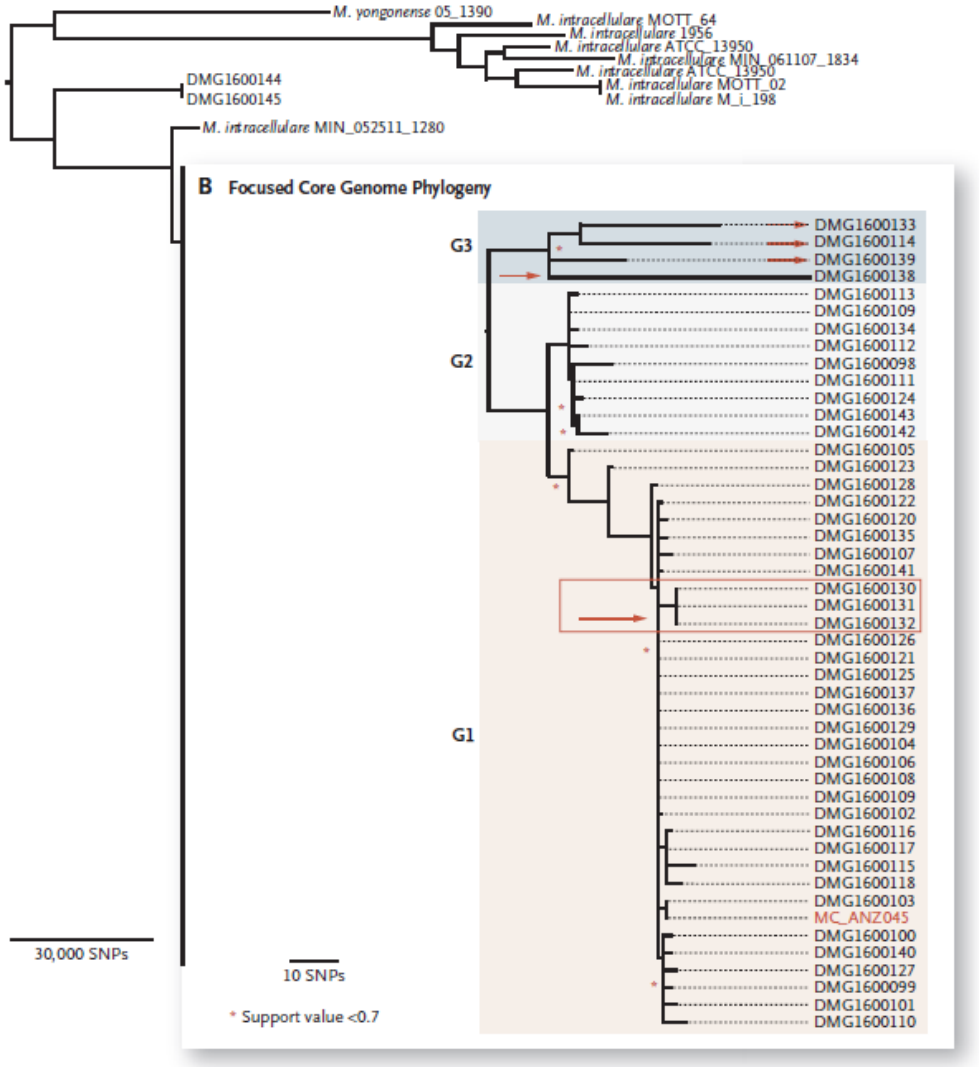
Mycobacterium chimaera: The reason



- All infections developed after the Stöckert 3T heating and cooling unit (Sorin)
- Whole-genome sequencing on 48 presumptive *M. chimaera* isolates from Australia and NZ
  - Indistinguishable at a core genome level

    → Common source

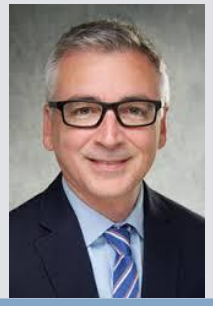
    → Contamination from manufacturers?
- Isolates from Northern Hemisphere with high level DNA conservation

Potential for global dissemination of contaminated medical devices

Williamson NEJM 2017

Imperial College London

Mycobacterium chimaera: Solutions



- Step 1: Determination of risk
  - Did your hospital has used the LivaNova Sorin T3 in last 6 years? Yes → Investigation
- Step 2: Risk mitigation
  - Get the units out of the operating room
- Step 3: Case identification and notification
  - Develop list of potentially exposed patients over the past 6 years
  - Notify potentially exposed patients (symptom screening by phone)
  - Notify referring providers and internal physicians
  - List of patients with MAC from blood, bone marrow or wounds last 6 years
  - Patient with consistent syndrome → 2-3 mycobacterial blood cultures, ID of isolates (ref lab)
  - Report M. chimaera cases

Sommerstein ICHE 2017

http://haicontroversies.blogspot.fr/2016/11/the-m-chimaera-how-to-guide.html

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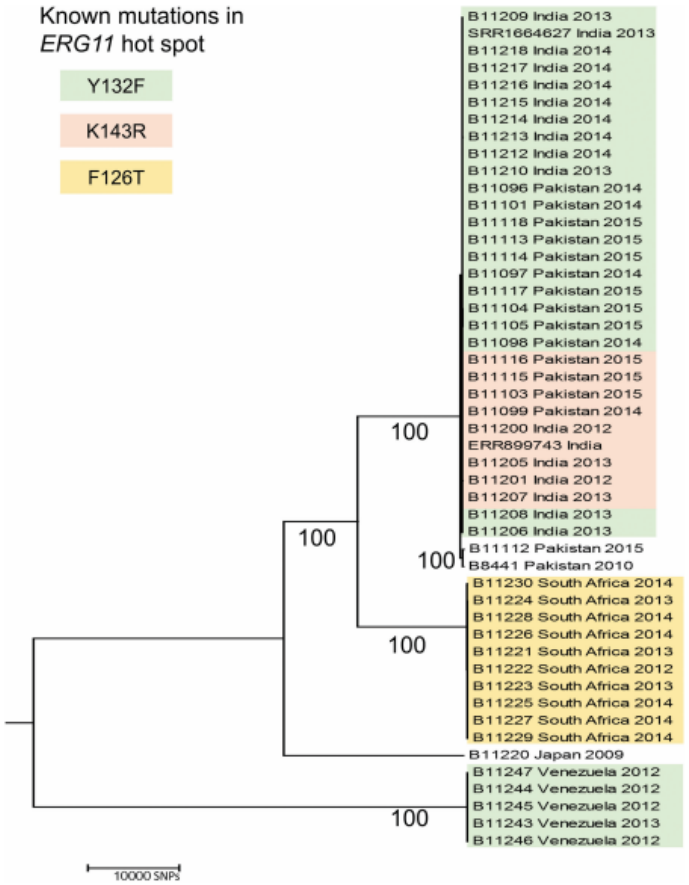
Spread of *Candida auris*

- Antifungal susceptibility testing WGS on 54 isolates from 5 countries



- Median time from admission to infection: 19 days (9–36
- 61% were BSI, and 59% of the patients died
- 41% resistant to 2 antifungal classes and 4% to 3 classes
- Unique clades by geographic region

→ New or increasing antifungal selection pressures?

→ Seem to be hospital acquired suggesting an exogenous rather than endogenous source and breach of IC measures

Lockhart CID 2017

Imperial College London

Spread of *Candida auris*

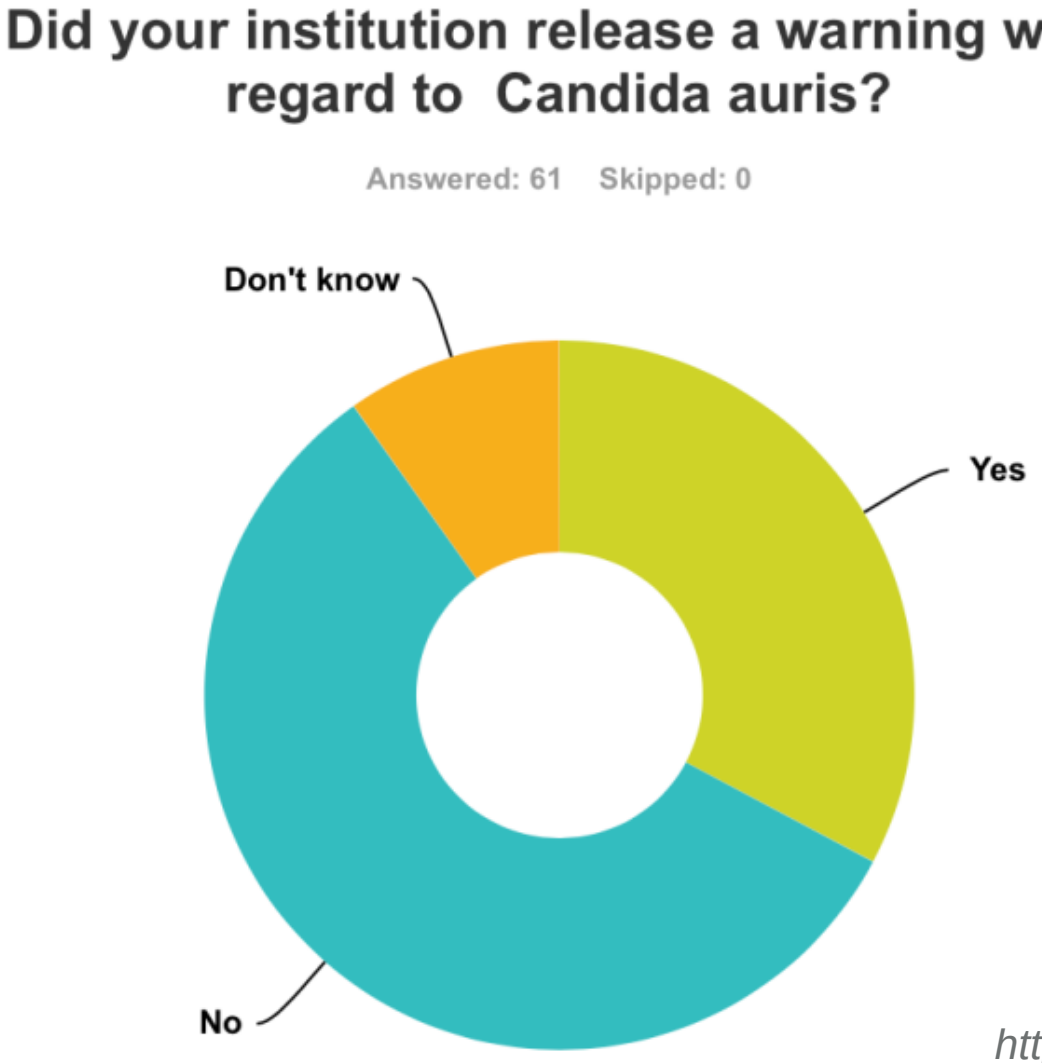
- 77 U.S. clinical cases of *C. auris* reported to CDC from 7 states
- Mainly blood (45 isolates), urine (11), respiratory tract (8)
- Swab of the groin and axilla for 390 close contacts of the 77 patients

  → 45 (12%) colonized persons identified
- Contact Precautions were recommended for colonized patients
- Environmental testing of patients' rooms identified *C. auris* from mattresses, beds, windowsills, chairs, infusion pumps, and countertops
- WGS: four distinct clades

Tsay MMWR 2017

Imperial College London

Spread of *Candida auris*



- 32.8%: release of warning about *C. auris* by institution
- 53.9% of the UK responders believe that their lab can correctly diagnose *C. auris*, versus 31.4% in the other countries

https://reflectionsipc.com/2017/05/26/c-auris-questionnaire-the-outcome/

Thank you for your attention

Ackowledgements: JC Lucet, A. Holmes

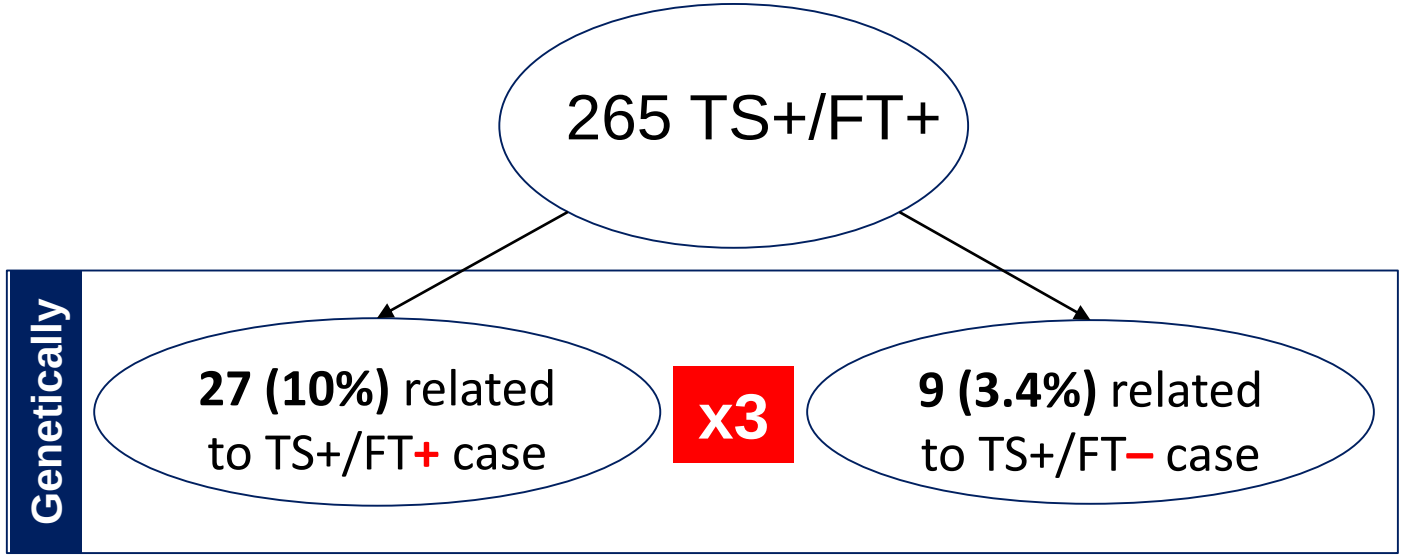
@Gbirgand

To get the slides: http://www.gabrielbirgand.fr

Imperial College London

Transmissibility of *C. difficile*

Objective: WGS & ward admission data to investigate CDI cases acquired from **symptomatic** patients with toxigenic *C. difficile* & fecal toxin negative



Imperial College London

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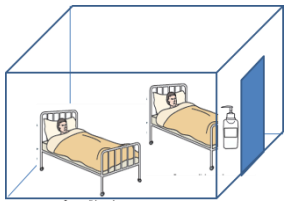

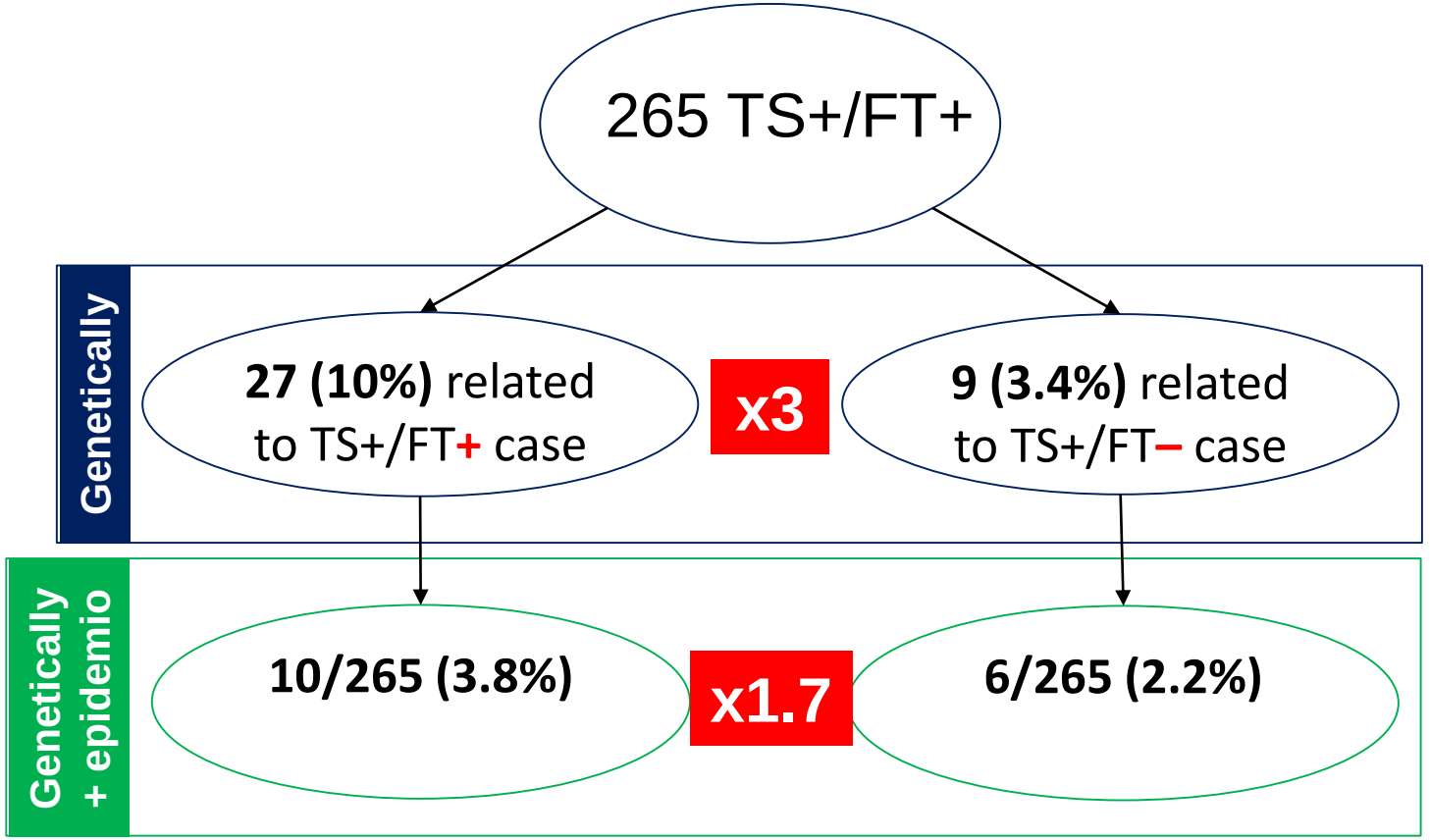

Mawer CID 2017

Imperial College London

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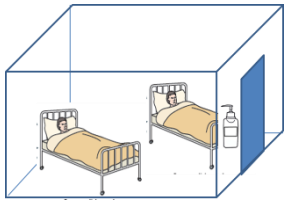

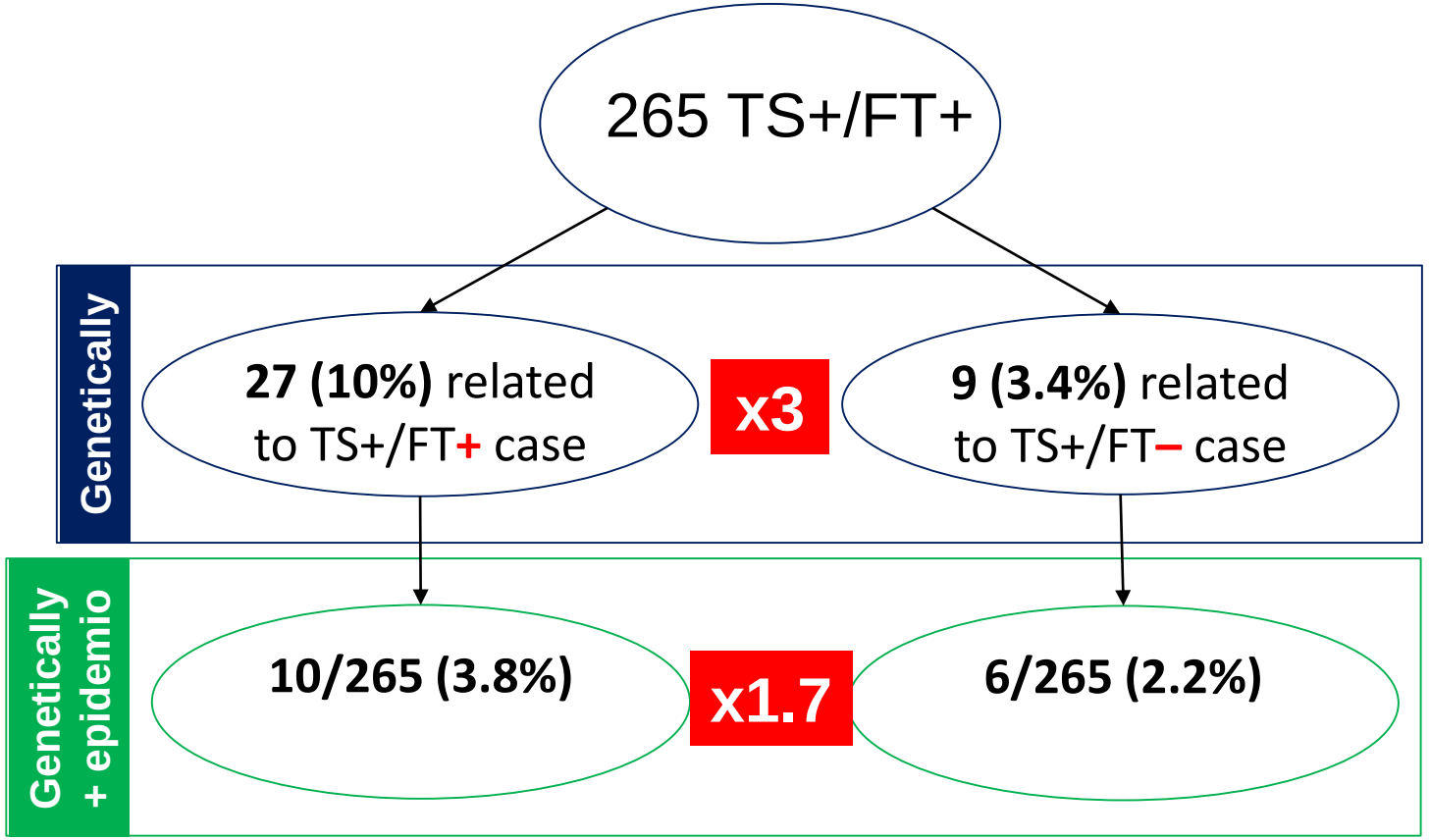

- Minority of CDIs acquired from other cases in endemic settings
- TS+/FT- generate ¼ of inhospital transmissions → routine isolation

Mawer CID 2017

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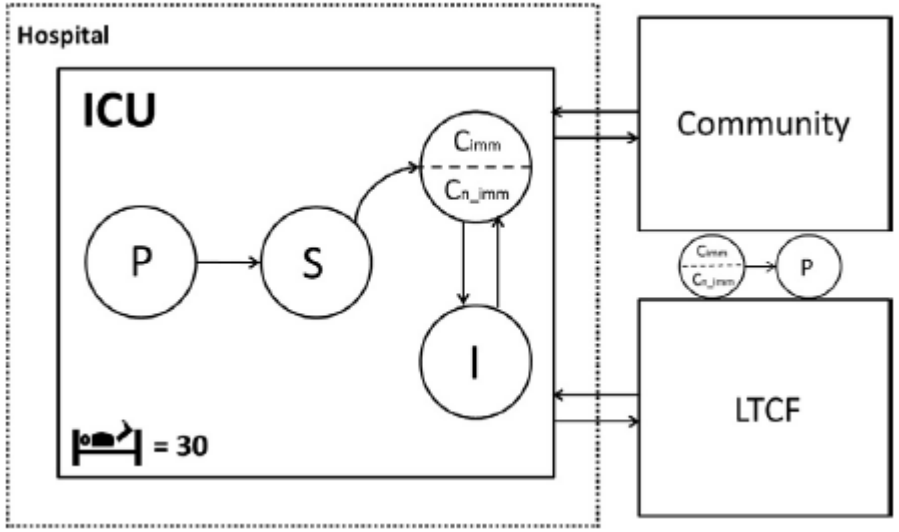
Vaccines & *C. difficile*

- Objective: model-based evaluation of the effectiveness of different CDI vaccination strategies

Base-case scenario:
10.9/1000 admissions
14.1 ward acquired/1000 admissions



Over 5 years	**Effectiveness** % ICU-onset CDI cases averted over 5 years	**Efficiency** Courses required to avert one ICU-onset CDI case
History of CDI in ICU	1%	81 [38–NA]
LTCF residents	8%	**13 [11–16]**
Elective surgery patients	**35%**	146 [133–162]
All combined	43%	124 [114–136]

- Lower levels ATB prescribing → reduction of vaccination efficiency
- ↗ Number of colonisations outside the ICU following vaccination
- Efficient when high transmission rates and ATB consumption

Van Kleef Vaccine 2016

Imperial College London

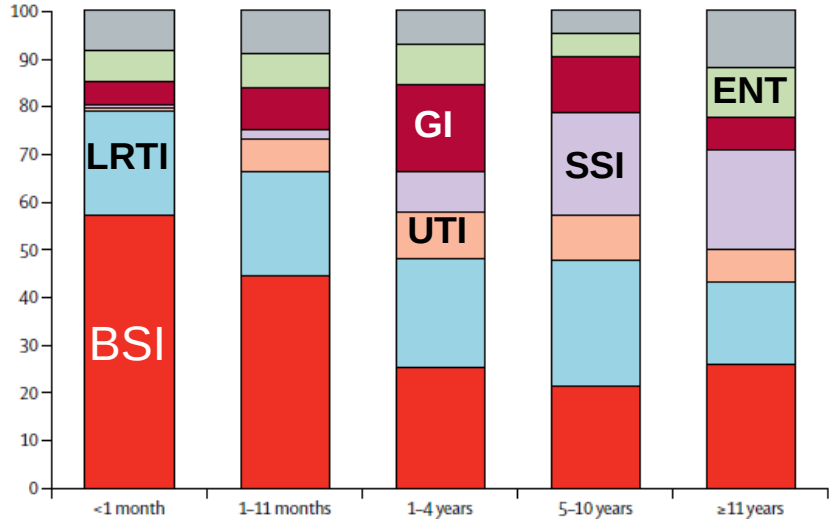
Epidemiology of HCAI

- European PPS of HAI in neonates, children, and adolescents 2011-2012
  - Children and adolescents (aged 0–18 years) hospitalised in paediatric wards, PICU and NICU → 17 273 were children in 29 countries
  - 770 HAI in 726 children: 4.2% (95% CI 3·7–4·8)
    - Highest prevalence in PICUs (15.5%) and NICUs (10.7%)
    - 592 (77%) of 770 HAIs in infants < 12 months

Enterobacteriacae

CNS

S.aureus



HCA prevention in children in Europe:
- Multinational quality improvement programme,
- on NICUs and PICUs
- on BSI

Zingg LID 2017

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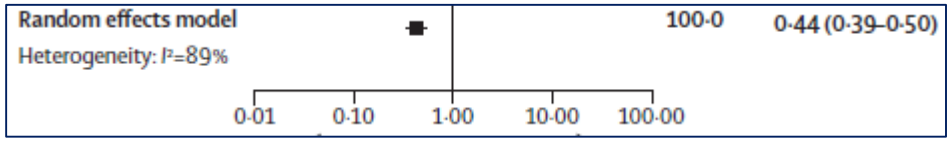
Bundle to prevent CLABSI

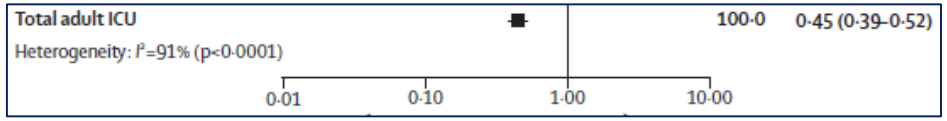
- Effectiveness of central-line bundles (insertion/maintenance) to prevent CLABSI: meta-analysis of 79 studies totalizing 2370 ICUs

Overall N=79

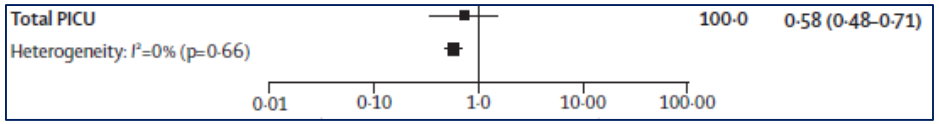


IRR 0.44, 0.39–0.50, p<0.0001

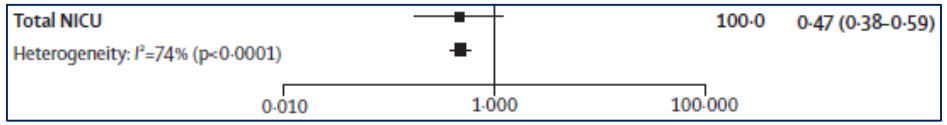
Adults N=53



PICU N=14



NICU N=14



Favours CVC bundles **Favours control**

Insertion bundle
- support of opinion leaders
- addition of hand hygiene
- having a central venous catheter kit
- proper selection of insertion vein in PICU

Maintenance bundle
- Hand hygiene
- Minimising of central-line access in the NICU

Ista LID 2016

Imperial College London

Costs & CLABSI

- Economic Evaluation of Quality Improvement Interventions for CLABSI
  - Systematic review: structure, process and outcome related costs
  - 15 unique studies in ICU setting: 11 on CLABSI & 5 on CRBSI

QI Interventions
6 Insertion checklists
11 physician education
3 ultrasound-guided placement
5 all-inclusive catheter kits
5 sterile dressings
2 antimicrobial catheters
4 simulation-based training
5 audit and feedback
4 empowering nurses to stop

	$ (IQR)
Program cost/hospital over 3 years	271 000 (417 000)
Incremental infection-related cost	−2.27 million (2.16 million)
themediannet savings	1.85 million (1.77 million)
Net saving of checkilst	1.12 million (1.31 million)

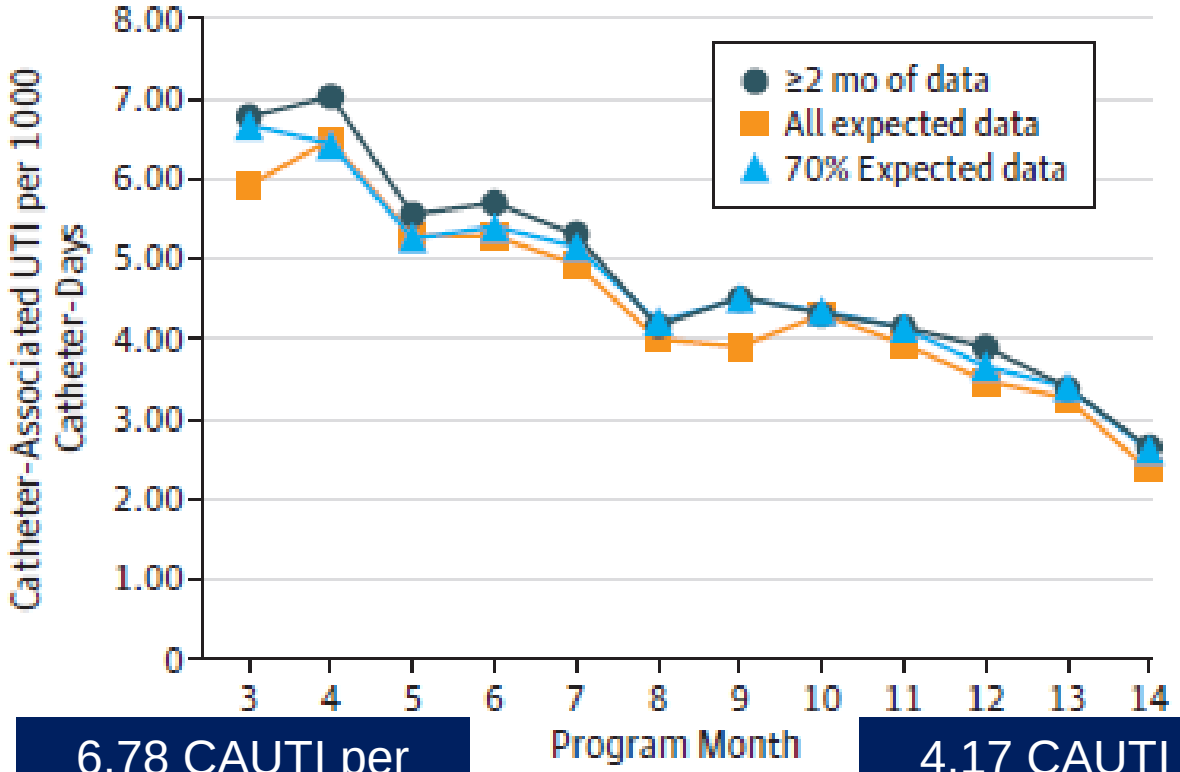
IRR: 0.43 (95%CI,0.35-0.51) → 57%decline in infections
Each additional $100 000 invested → $315000 higher savings

Nuckols JAMA Int Med 2016

Imperial College London

Prevention of CAUTI in Nursing Home

- 568 community-based nursing homes



6.78 CAUTI per 1000 catheter-days
4.5% catheter use

4.17 CAUTI per 1000 catheter-days
4.9% catheter use

Mody JAMA Int Med 2017

Imperial College London

Prevention of CAUTI in Nursing Home

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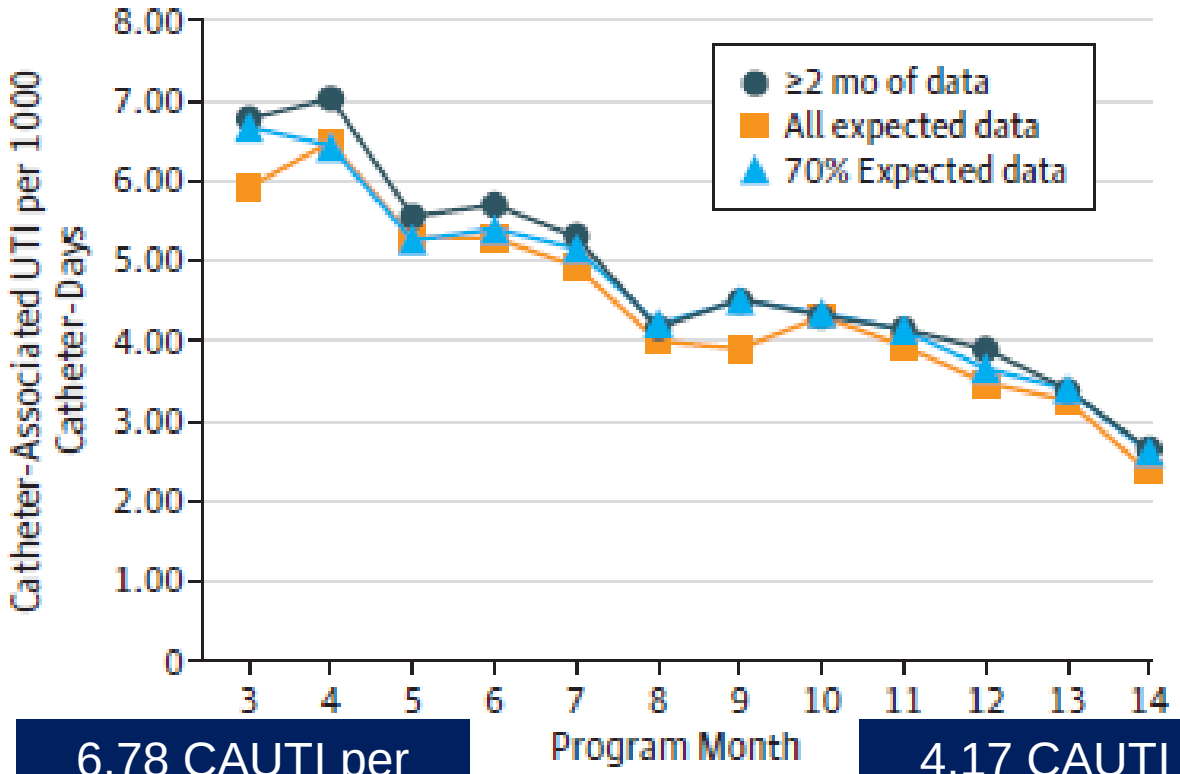

6.78 CAUTI per 1000 catheter-days
4.5% catheter use

4.17 CAUTI per 1000 catheter-days
4.9% catheter use

Reasons of success:

1. Emphasizing foundational IPC measures (ie urine culture)
2. Educational sessions, interaction, infography, pocket card
3. Attention to **socio-adaptive** elements
4. Sustained external support: monthly coaching calls

Mody JAMA Int Med 2017

Enhanced Recovery After Surgery to prevent HAI

- Hypothesis: Enhanced Recovery After Surgery/Fast Track Surgery improve the speed of postoperative + prevent HAIs
- Method: Meta-analysis of 36 studies → pooled effect of ERAS and FTS on incidence of post-operative Lung Infection, UTI, and SSI
- Results: 41 comparisons ERAS/FTS vs conventional care in GI surgery

Grant Ann Surg 2017

Imperial College London

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	RR (95% CI)	P value
Lung infection (n=16)	0.38 (0.23–0.61)	< 0.0001
UTI (n=16)	0.42 (0.23–0.76)	0.004
SSI (n=27)	0.75 (0.58–0.98)	0.04

Improved surgical pathway:

- Teamwork, safety culture, communication linked to surgical outcomes
- Transdisciplinary teamwork and coordination from preop outpatient to postdischarge

Grant Ann Surg 2017

Imperial College London

Antimicrobial prophylaxis for C-section

- Objective: Benefits and safety of azithromycin prophylaxis in women undergoing nonelective cesarean section to coverage for ureaplasma
- Design: RCT (1:1) in 14 centers, 1019 with 500 mg of intravenous azithromycin vs 994 with placebo.

	Azithromycin	Placebo	Relative Risk, p
Primary composite outcome	62 (6.1)	119 (12.0)	0.51 (0.38–0.68), p=0.001
Endometritis	39 (3.8)	61 (6.1)	0.62 (0.42–0.92), p=0.02
Wound infection	24 (2.4)	66 (6.6)	0.35 (0.22–0.56), p=<0.001

Addition of azithromycin to standard antibiotic prophylaxis significantly reduced the frequency of infection after non-elective cesarean Section without increasing the risk of neonatal adverse outcomes

Tita NEJM 2016

Imperial College London

Patient engagement for prevention

- How to empower patients & which recommendations need to be given by healthcare workers?

9 fundamental recommendations
1. S. aureus screening and decolonization
2. Smoking
3. Hair removal
4. Hand hygiene
5. Body temperature
6. Preoperative showering and bathing
7. Diabetes mellitus
8. Wound care after surgery
9. Multidrug-resistant organism risk (MDRO)

Education opportunities
• Leaflet format
• To meet various health literacy
• Various educational programs
• Social media
• Facility websites, on electronic devices

facebook YouTube

Tartari ARIC 2017

Imperial College London

Antibiotic treatments & VAP

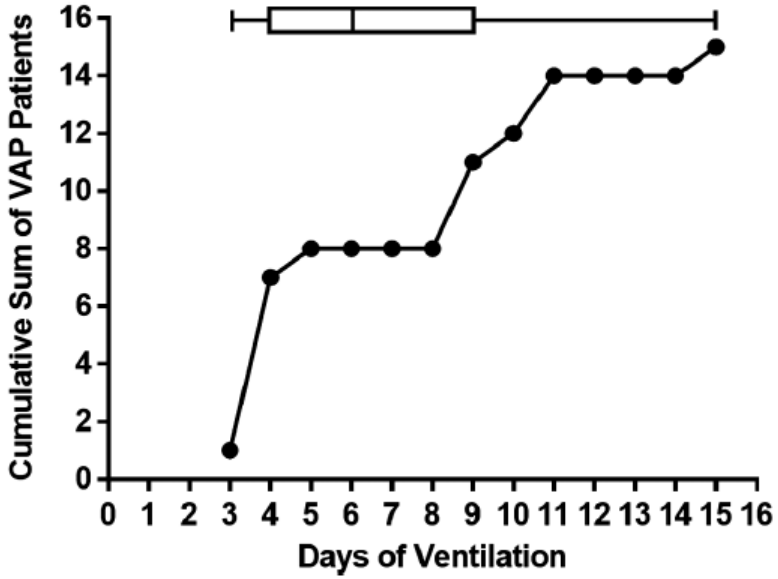
- Objective: Efficacy of antibiotics on *S. aureus* airway colonization and/or prevention of VAP
- Method: 56 patients (292 samples) in 3 ICUs with S. aureus positive Endo Tracheal Aspirations
  - 48 received S. aureus antibiotics (vancomycin, oxacillin, linezolid)
  - Ventilator Associated Tracheobronchitis: Heavy colonization + 2 of the following 3 criteria: fever or hypothermia, leukocytosis or leukopenia, and purulent respiratory secretion
  - VAP: additional new infiltrate on chest radiographs

Stulik CID 2017

Imperial College London

Antibiotic treatments & VAP

18 Vancomycin—MRSA
3 Linezolid—MRSA
15 Vancomycin—MSSA
9 Oxacillin—MSSA)



13 VAT cases & 15 VAP cases diagnosed among 39 patients colonized only by *S. aureus*

- Low efficacy of antibiotic treatment (especially vancomycin) to reduce *S. aureus* colonization of the lower airways in ventilated patients and to VAT and VAP
- Oxacillin was more effective at reducing heavy MSSA colonization (often combined with other ATB) → 1/3 of VAP

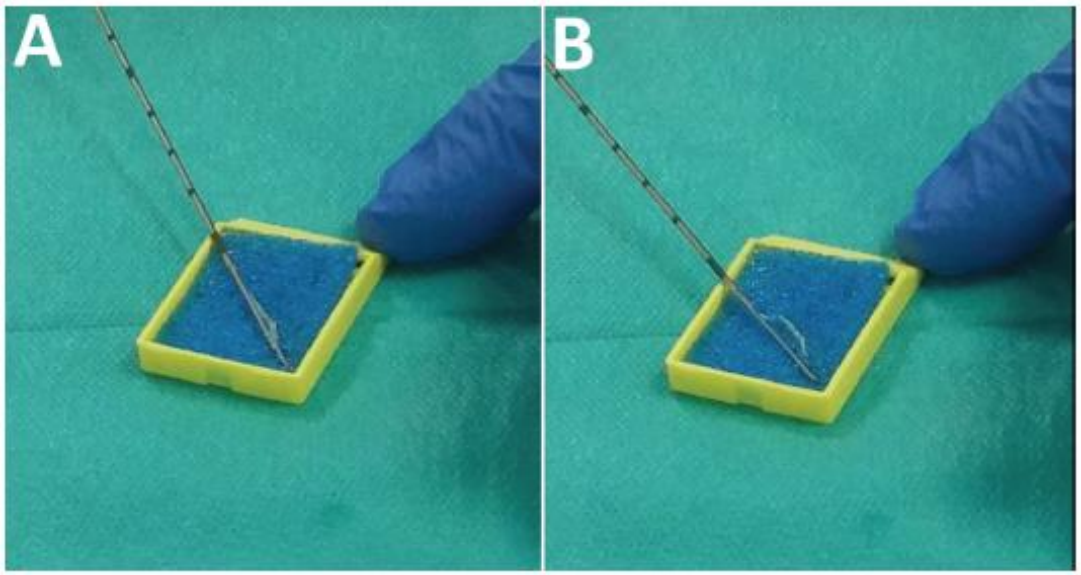
Stulik CID 2017

Imperial College London

Outbreak following Prostate biopsy

- Investigation of an outbreak of HA-UTIs after prostate biopsies
  - 6 patients with dysuria and UTIs <10 days after prostate biopsy

    → 4 *Achromobacter xylosoxidans* UTIs and 2 *Ochrobactrum anthropi* UTIs



Haviari EID 2016

Imperial College London

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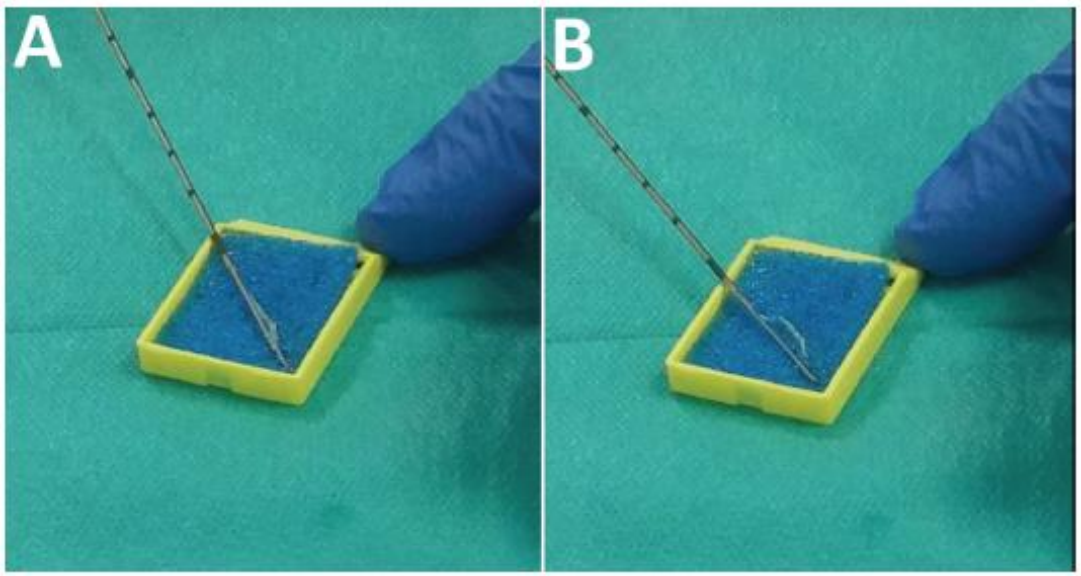

Facility inspection:

- Sterile sponges touched by contaminated hands
- Container of sponges reused from day to day, never completely dried

→ Sponges positive for 5 species including *A. xylosoxidans, O. anthropic*

→ 1st procedure of the day and identity of the main operator associated with increased infection risk

Haviari EID 2016

Spread of *Candida auris*

- Why is *C. auris* often misidentified in the routine microbiology lab?
  - Lack of yeast in commercial identification systems databases
- Does genetic predisposition make *C. auris* virulent?
  - Expresses several virulence factors, but strain dependent
- Is the emergence of C. auris a menace to public health?
  - Yeast exhibits MDR clonal strains nosocomially transmitted unusual
- What are the drivers of clonal/nosocomial transmission of *C. auris*?
  - Environment, Patient to patient, HCW colonization

Chowdhary Plos Path 2017

Imperial College London

Spread of *Candida auris*

- Report of a 50 case ongoing outbreak of *C. auris* Royal Brompton in London
- IPC measures implemented
  - Isolation of case patients and their direct contacts (gloves, aprons AND gowns)
  - Screening of contact patients: 1/2246 (0.04%) positive
  - Decolonisation of case patients using chlorhexidine + staff (1/258)
  - Closure of affected areas to new admissions
  - Thrice daily bleach for positive patient rooms, terminal using hydrogen peroxide vapour